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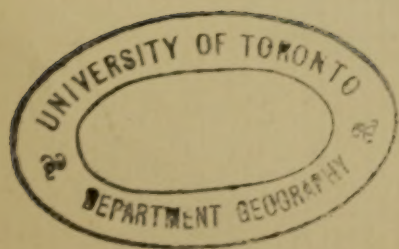
THROUGH THE FIRST ANTARCTIC NIGHT



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An Antarctic Iceberg

THROUGH THE FIRST ANTARCTIC NIGHT

1898-1899

A NARRATIVE OF THE VOYAGE OF THE "BELGICA" AMONG
NEWLY DISCOVERED LANDS AND OVER AN UNKNOWN
SEA ABOUT THE SOUTH POLE

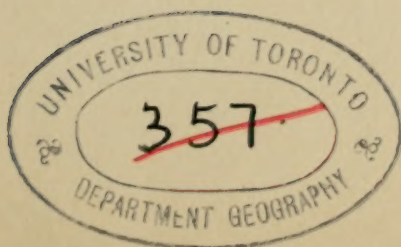
BY
FREDERICK A. COOK, M.D.

SURGEON AND ANTHROPOLOGIST OF THE BELGIAN ANTARCTIC EXPEDITION
WITH AN APPENDIX CONTAINING A SUMMARY OF THE SCIENTIFIC RESULTS

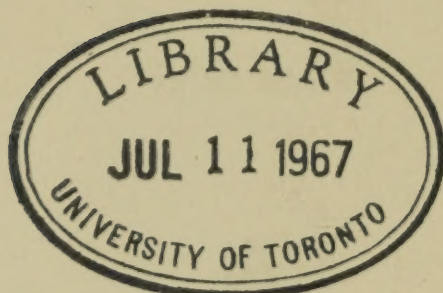
Illustrated



WILLIAM HEINEMANN
LONDON
1900



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and *McClure's*. Though this material has been much changed
and rewritten, my acknowledgments are due to these magazines.

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TO THE LITTLE FAMILY,
THE OFFICERS, THE SCIENTIFIC STAFF, AND
THE CREW OF THE "BELGICA,"
WHOSE FORTUNES AND MISFORTUNES MADE
THIS STORY OF THE FIRST HUMAN EXPERIENCE
THROUGHOUT A SOUTH POLAR YEAR;
TO THESE MEN,
WHOSE CLOSE COMPANIONSHIP AND STURDY
GOOD-FELLOWSHIP MADE LIFE ENDURABLE
DURING THE STORMS, THE
DARKNESS, AND THE MONOTONY
OF THE ANTARCTIC,
THIS BOOK IS DEDICATED.

INTRODUCTION.

For three hundred years explorers have been active in pushing aside the realms of the unknown towards the north pole; but the equally interesting south pole has, during all this time, been almost wholly neglected. There have been expeditions to the far south, but compared to arctic ventures they have been so few and their work within the polar circle has been so little that the results have been largely forgotten. It is not because valuable results have not been obtained in the antarctic, but because the popular interest in the arctic has completely overshadowed the reports of the antipodes. The search for the North-west and the North-east passages, which commerce demanded to reach the trade of the Orient during the seventeenth and the early part of the eighteenth centuries, fixed the public eye persistently northward. This extended effort to find an easy path to the wealth of Asia was fruitless, but it was followed by a whale fishery, a sealing industry, and a fur trade, which has proven a priceless boon to mankind. As a result of these two periods of trade exploration, we have now entered upon a third stage, a period of scientific research which will not, and should not, end until

INTRODUCTION

the entire area is outlined in the growing annals of exact knowledge.

The antarctic has a history somewhat similar, but it is almost forgotten. Until 1772 the south frigid zone was pictured by fiction writers in flowery phraseology. They placed here a fertile country, projecting far northward into the Atlantic and the Pacific. This land was supposed to be inhabited by a curious race of people who possessed a superabundance of gold, precious stones, and other material wealth. To learn the truth of this new "land of promise" Capt. James Cook was sent out in 1772. Cook, with a thoroughness which characterised all his efforts, circumnavigated the globe close enough to the antarctic circle to convince the world that if land of large extent existed around the south pole it must be far beyond the usual ice-limits. Sixty years later, through the efforts of American and British sealers who had searched every known rock of the southern seas for fur-seals, and sea-elephants, the United States, England, and France, fitted out rival expeditions. The combined work of these expeditions marked the second period of antarctic exploration and resulted in the re-establishment of a great polar continent on the Austral chart. Sixty years again passed before another expedition was sent to press beyond the southern barriers of ice. The voyage of the *Belgica* is the beginning of a third revival of antarctic exploration which has been brought about by determined efforts, made almost simultaneously in England, Germany, Belgium, and the United States.

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This third period of antarctic research, like the third stage of arctic exploration, is wholly in the interest of science.

The first country to complete the outfit of a modern expedition was Belgium. England and Germany now have expeditions in preparation, but the honour of being the first to send a scientific venture, with trained specialists and appropriate equipment to the antarctic, belongs to Belgium.

For the origin of the Belgian Antarctic Expedition we are indebted to the energetic efforts of Lieutenant Adrien de Gerlache. By soliciting private subscriptions and finally by securing the financial aid of the Belgian Government, Gerlache succeeded in collecting the sixty thousand dollars which were barely sufficient to fit out the enterprise. The vessel selected for the mission was the Norwegian sealer *Patria*, which was rechristened *Belgica*. She is a strong vessel, of about two hundred and fifty tons, built some ten years ago. She was not strengthened or altered on the plan of Nansen's vessel, the *Fram*, as has been so often stated. Nevertheless, she proved herself a craft of extraordinary endurance, withstanding the thumps of rocks, iceberg collisions, and pressure in the pack-ice, in a manner perfectly marvellous. Owing to a scarcity of funds, the accoutrements of the ship and the outfit for polar exploration were somewhat imperfect. If we had been compelled to stay longer, or if it had been necessary to make a forced overland journey, or a retreat homeward on the ice, we should have found our equipment inadequate.

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The members of the expedition were from many lands, as the following list will show:

Commandant, Adrien de Gerlache (Belgian).

Captain, Georges Lecointe (Belgian), Executive Officer and Hydrographer.

Roald Amundsen (Norwegian), 1st Mate.

Emile Danco (deceased) (Belgian), Magnetician.

Emile Racovitza (Rumanian), Naturalist.

Henryk Arctowski (Russian), Geologist, Oceanographer and Meteorologist.

Antoine Dobrowolski (Russian), Assistant Meteorologist.

Frederick A. Cook (American), Surgeon Anthropologist and Photographer.

ENGINEERS.

Henri Somers (Belgian). Max Van Rysselberghe
(Belgian).

SAILORS.

BELGIANS.

Jules Melaerts.

Jan Van Mirlo.

Gustave Dufour.

Louis Michotte.

NORWEGIANS.

Adam Tollefsen.

Hjalmar Johansen.

Johan Koren.

Engebret Knudsen.

Carl Augustus Wiencke (deceased).

Altogether we numbered nineteen when leaving Punta Arenas — seven officers, housed in the cosy little cabins, and twelve marines, including Dobrowolski, housed in the forecastle. Thus divided, we were two happy families, and as such we tried to

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extract from the frozen south polar surroundings such rare comforts as regions of perennial snows afford.

The *Belgica* left Antwerp at the end of August, 1897. She steamed and sailed down the Atlantic to Madeira, then across to Rio de Janeiro, down to Montevideo, and into the Strait of Magellan to Punta Arenas. After spending some time in the Fuegian channels and among the Cape Horn Indian tribes, we took our departure from the known world, at Staten Island on January 13, 1898. We sighted the South Shetland Islands a week later, where, during a violent tempest, we lost by an accidental fall overboard, the young and faithful Norwegian sailor, Wiencke. We next crossed the ever-foggy and ever-tempestuous waters of Bransfield Strait, and on the afternoon of January 23, 1898, came in sight of the outer fringe of a new land, the Palmer Archipelago. Entering this, we discovered a new highway, which in size compares favourably with Magellan Strait. To the east and west of this strait, we charted about five hundred miles of a land which had never before been seen by human eyes — part of a great continental mass which probably surrounds the south pole. It is buried even in midsummer under a ponderous weight of perennial ice. Passing out of the strait, we entered the South Pacific, and after skirting the western border of Grahamland to Adelaide Island and then to Alexander Island, we attempted to enter the main body of the pack-ice westward.

The work of the first three weeks in the new regions proved the discovery of a highway per-

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fectly free for navigation during the summer months from Bransfield Strait, two hundred miles south-westerly, through an unknown land to the Pacific. This highway has received the name of our ship. To the east of Belgica Strait we discovered a high, continuous country which probably connects with the land charted as Grahamland. This has been christened Dancoland, in memory of our companion, Lieutenant Danco, who died on the ship during the long drift in the pack-ice. The land to the west of the strait is cut up into islands by several channels, and is named Palmer Archipelago, in honour of Captain Nathaniel Palmer, the American sealer who was the first of all men to see the outer fringe of this land. Scattered about in the waters of Belgica Strait are about one hundred islands and several groups of islands. About fifty of these are of considerable size. The islands, the capes, the bays, the headlands, and the mountains have mostly received the names of Belgian friends of the expedition; but prominent outside workers have not been forgotten, as is evidenced by Nansen Island and Neumayer Channel. Each officer was given the privilege of bestowing some names. Hence two islands which fell to my lot are named after the city of my home and the first mayor of Greater New York—Brooklyn and Van Wyck Islands.

After passing out of the strait into the open Pacific, we strove to follow the mainland southward, but the pack-ice forced us away. Late in February we entered the main body of the sea-ice, intending

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to push southward and westward. After penetrating ninety miles we found ourselves firmly beset. Unable to extricate the ship, we drifted with the ice to and fro, but generally west, for thirteen long months. During the early part of the long polar night Lieutenant Danco died. Except for the depression of this melancholy bereavement, the health of the members of the expedition was fairly good; but the seventy days of continued darkness weighed heavily upon us. The scientific work was prosecuted throughout the year of the drift. Each department has reason to feel proud of its records. But all were happy when, on March 14, 1899, we were released from the icy fetters which had held us so long.

We left the pack from longitude 103° west of Greenwich, and latitude $70^{\circ} 45'$ south. We had thus drifted from about 85° to 103° of west longitude and between 70° and 72° south of latitude. In March and April we drifted westerly to longitude $92^{\circ} 25'$, where we were on April 25th. From May to October we drifted back again to a place near our starting point. From November to the time we left the ice we drifted rapidly westward. The winter drift then is eastward, the summer drift is westward, and this is also the direction of the prevailing winds. Our farthest south was on May 31st, latitude $71^{\circ} 36' 5''$ south, longitude $87^{\circ} 40'$ west. It would not at any time have been possible to push farther poleward in our position. The various soundings which we took prove the existence of a sea where there was previously thought to be land. Through

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these soundings also we have discovered a submarine bank comparable to the bank off the coast of Newfoundland. The excellent series of magnetic observations by M. Lecointe indicate the magnetic pole to be about two hundred miles east of its present assigned position. The hourly meteorological observations, under the direction of M. Arctowski, are of priceless value to students of weather. The painstaking zoölogical work by M. Racovitza, and the numerous other observations and studies of antarctic life and phenomena, are of a like value. As an American I can with due modesty say that the work of this, the Belgian Antarctic Expedition, will form the stepping-stone to future antarctic exploration.

In the following pages I have not attempted to elaborate on our experiences and observations. This I leave for a future work. My aim has been to select from my diary and notes such data as might prove of interest to the general reader. In my desire to condense this story into a single volume I have omitted much of the daily routine of life. I have also omitted a discussion of technical topics. There is no pretence made by me that this book contains all of the scientific data of the expedition. The observations, descriptions of specimens, and scientific deductions will be published in other channels. The Belgian Government has liberally set aside a sum sufficient to publish in proper form the scientific records, and a commission is at present occupied in making a preliminary study of the material with this end in view.

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We did not start out to mount the south pole, as we have been reported. Our aim was a less ambitious work of scientific exploration along the edge of the unknown. In this we were reasonably successful. My story, then, is not one of pole-chasing, with its many certain disappointments. It is a record of the first expedition to pass through the ordeal of the long antarctic night and its gloomy winter storms. It is, I hope, a contribution of new human experience in a new, inhuman world of ice.

The illustrations in this book are made, with but a few exceptions, from photographs, and since these are the first photographic reproductions of antarctic life and scenes, it is hoped that they will be of value as records of the unknown south. In the color plates we have aimed to give a few examples of the daily touches of colour, which serve to relieve the awful monotony and glittering whiteness peculiar to the south polar regions. The vivid complexity of delicate shades of most scenes is impossible of imitation by the present means of the printer's art, but the success attained by the artist, the engraver, and the printer in these reproductions has been an agreeable surprise to me.

In the notices of my return from the antarctic, and in the story of the Belgian Antarctic Expedition, as published in the American newspapers, it has unintentionally been made to appear as if I desired to claim a major share of the credit for the results of this expedition. This I wish to disclaim. The credit of organising the expedition belongs to its Commander, Adrien de Gerlache; the honour of sending out the

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venture belongs to the enterprise of Belgian citizens. The fame and honour, which are the results of a successful expedition, belong to every member of the expedition. Every one, from the highest officer to the cabin-boy, has done his share of the work nobly and faithfully. Everyone, then, from the cabin to the forecastle, deserves equally the honorable mention which is the explorer's only pay.

FREDERICK A. COOK, M.D.

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BOROUGH OF BROOKLYN,
NEW YORK.

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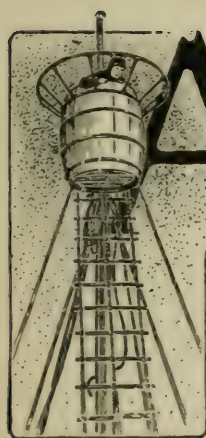
THROUGH THE FIRST
ANTARCTIC NIGHT

THROUGH THE FIRST ANTARCTIC NIGHT

CHAPTER I

IN AND ABOUT RIO DE JANEIRO

RIO DE JANEIRO, October 30, 1897.



THE CROW'S NEST

AT last I am on the way to the land which has been the dream of my life, — “the mysterious antarctic.” I have talked of this journey of exploration so long, have wished for it so persistently, that now, when my one foremost ambition seems on the verge of a realisation, I can hardly assure myself that I am not on the road to another of many disappointments.

In three weeks one half of the distance in an air line from New York to the south pole was traversed, and here on the lower edge of the tropics I have waited for the arrival of the ship with the company of Belgian explorers with whom the journey to the antarctic, now just begun, is to be made.

On my arrival at Rio de Janeiro the Belgian Legation looked after my comforts, and the Minister, Count van den Steen, offered me the hospitality of his home at Petropolis.

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After a fortnight of dreamy tropical life, a telegram announced the arrival of the expedition ship, the *Belgica*, in the Rio harbour. We took the early morning train and slowly descended the two thousand feet along several valleys, winding around various hills, down and down on the curious cog-wheel railroad, until we reached the head of the bay. Here an old-style side-wheel steamer carried us to Rio de Janeiro. On the pier a delegation appointed by the Belgian colony of Rio met us with a tug, in which we were carried to the *Belgica*.

There was nothing about the *Belgica* to attract unusual attention from a distance. She was rather odd in shape and colour, but Rio harbour is full of weird-looking crafts. We boarded the *Belgica* at about 11 o'clock. It was a scorching morning, and as we ascended the sea ladder a cloud of hot vapour rose above us from the moistened decks. The Captain, Lecoinge, was at the gangway and greeted each visitor as the Minister introduced us. Behind him on deck stood Commandant de Gerlache, at his side the officers and scientific staff, while the crew was stationed on the port side of the quarter deck.

To me this was a moment of special interest. Here for the first time I met face to face the party of total strangers, the members of the Belgian Antarctic Expedition, with whom I am to remain as companion and co-worker for a period of months, perhaps years. I was greeted in a strange tongue—French—not a word of which I understood. One after another came to me asking questions, but I could only look askance at them. After a while I

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learned that the Commandant could speak English and all of the scientific staff could speak German, so we began to exchange ideas in tongues familiar to me.

My first impression of the officers and crew was—as it is to-day—decidedly favorable. Every one seemed a picture of health, full of youthful vigour, and jolly good fellowship. The *Belgica* appeared small, but she seemed well adapted to the prospective work, and above all, she was filled brim full with good food,—such delicacies as only a Belgian could select. I am sure as we penetrate the white antarctic she will seem large enough; she will afford us a safe home, and many, very many, comforts, as comforts go in the polar regions.

The *Belgica* left Ostend, Belgium, on August 24, 1897, and reached Madeira September 13. From here, after an adjustment of the instruments and some scientific observations, lasting three days, she sailed for Rio de Janeiro; but Rio was not reached until late in the afternoon of October 22. The voyage was made against a series of adverse winds and calms, making it necessary to steam a part of the time. Excepting a few cases of seasickness the party enjoyed excellent health while crossing the tropics.

The general plan of the expedition was now for the first time outlined to me by Commandant de Gerlache. Up to the present all my communications had been by cable, and necessarily brief, but now I was able to elicit from the hardworked projector the prospective plan of our campaign. The *Belgica* will start from here, after the magnetic instruments are ad-

THROUGH THE FIRST

justed, for Montevideo, where she will stop perhaps two days. From Montevideo we will proceed to Punta Arenas, Chile, in the Strait of Magellan.

At Punta Arenas we shall make some scientific observations and collections, stopping perhaps eight days. And then, after coaling and restocking our provision supply, we shall sail for the South Shetland Islands, thence to Grahamland, and southwestward along its border to the limit of navigation. If time and ice conditions will permit we shall first sail along the eastern shore of Grahamland and south into Weddel Sea. But this journey, tempting as it seems, is now rather doubtful, owing to the short time at our command. From this western terminus of Grahamland we shall try to map the coast to Alexanderland and beyond as far as possible, then we are to press southward and westward to Victorialand. Deep sea soundings and dredgings will be taken wherever the opportunity presents. Systematic, magnetic, and meteorological observations are to be made, and large zoölogical collections are expected. In a general way it is the aim of the expedition to make a thorough scientific survey of the regions traversed. The commander reserves the right to alter any or all plans to suit unexpected conditions as we meet them.

In the afternoon the Minister, Count van den Steen, took Commandant de Gerlache and most of the scientific staff ashore to begin the first of a long series of presentations and introductions to the congenial Brazilian officials. We were first presented to the chief of customs and the Minister of marine

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affairs, from whom we derived the twofold pleasure of being warmly greeted and freed of harbour dues, custom annoyances, and other troublesome local regulations.

It was to me a source of never-ceasing interest to note the translations of the various questions asked. This portrayed clearly the Brazilian notion of a polar expedition. The ideas proved to be so tropical that I must risk a breach of etiquette and quote enough to show Brazilian versions of polar work. We were constantly asked, "Have you a smoking-room and much tobacco?" "Of course you have lots of wine and other nice drinks, but have you plenty of good things to eat? You must take some Brazilian coffee." Others would put to us questions about our provision for pleasure, music, games, and pastimes in general, but I do not remember having been asked even once about the serious scientific work of the expedition. One broad-minded and apparently intelligent fellow, well on in the winter of life—a member of the Cabinet, asked the usual questions about wines, cigars, and personal comforts, and then, having heard of Mrs. Peary's experience in the North; he asked if we had any women among us? On being answered with a rather sharp and quick "no!" he remarked: "Then, I don't want to go along."

This explains the lack of interest of South Americans in anything polar. So long as beautiful women, good wines, fine cigars, and delicate foods are not found at the south pole, Latin Americans will probably not aspire to reach it.

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The magnetic instruments were taken to the local observatory for adjustment and comparison. To do this properly required about a week, hence arrangements were made for various receptions, tours of exploration, of pleasure, and what not. The zoölogist, Mr. Racovitza, learning that he could take a fast steamer and reach Punta Arenas about a fortnight in advance of the expedition, at once made arrangements to leave us. This will afford him much additional and valuable time to make collections and observations in the immediate vicinity of the Strait of Magellan.

We began the week on Monday by the Presidential reception. The Belgian Minister, Count van den Steen, had arranged the details and according to his instructions we assembled at the office of Consul Laurys shortly after noon. From here we embarked in coaches drawn by small but handsome mules. We were hurried through narrow streets, along an endless number of low houses, plastered outside and in. The doors and windows were full of men, women and children, scantily dressed but ill at ease, all doing nothing in various ways.

In a half hour we reached the White House, an imposing and substantial building constructed from the local schist which everywhere underlies the city. Led by Count van den Steen we entered, ascended to the third floor, and were marshaled to the President's reception room with very little ceremony. The room was handsomely decorated by wall paintings, and fresco decorations probably of Italian design, while the floors were of beautiful inlaid wood,

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also of a foreign manufacture. There were no carpets, but little furniture, and the mantels were covered by artificial flowers and plants.

In a short time the President, Senor Trudente de Moreas Barros, entered. We were presented separately, after which the Minister made a short address in French to which the President replied in a few words, and then grasping our hands he offered a cheerful greeting to each member of the expedition.

The Belgian colony had long planned a feast for the expedition, and this was to be the grand event at Rio, to which we looked for real joy and lasting comfort. The time had been set for the evening of the 25th, at the Restaurant Petropolis, on Rue de Ovidor. We assembled at 7 o'clock; there were about 100 people present, representing the male members of the Colony, the officers and scientific staff of the expedition, and a few newspaper editors.

The room was large and airy; electric fans were in position, but the air was cool enough without their use. The walls were decorated with flags, and the tables with flowers and fruits. The bill of fare was Belgian—a few local additions to the very best that could be imported from Belgium. This, I am sure, is sufficient said of a very delightful collection of rare foods and good drinks. There was much enthusiastic speech-making and toasting in French, Portuguese, and Italian; presumably complimentary to Brazil, Belgium and the expedition, but I did not understand it. The spirit of hilarity, however, was in the air and, although I was a for-

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eigner among strangers whose language was unknown to me, I cannot remember having enjoyed a banquet at home better. We had all been wined and dined, separately and collectively, before and after, but the occasion which will always remain in our minds as the best treat of all is the Rio Belgian banquet.

The day following, and for the balance of the week, we visited the local places of interest, explored the city in various ways, and were received at a special meeting of the local Geographical Society. Rio de Janeiro is a city of perhaps six hundred thousand inhabitants, with about one hundred thousand foreigners. It is the metropolis of South America, but far, very far, behind Montevideo and Buenos Aires in modern improvements and in all the present arts of civilization. It is essentially a commercial city, a center from which exports are sent and imports distributed throughout Brazil and much of South America.

A great deal of money is made here, but the present money has fallen to about one eighth of its actual value. Things cannot be much longer prolonged as the present money market stands, from which it follows that various rumors of a national bankruptcy are current. A well informed resident assured me that a crisis would arrive before our return from the antarctic.

Brazil, in the infancy of its republican form of government, has very many political difficulties to settle. There is more political discussion to the square mile in Rio de Janeiro to-day than to an equal space on any other part of the globe with which I am familiar.

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A rebellion has just been subdued in a northern province, but from the south comes fresh news of another attempted secession. The several states of Brazil seem to be loosely bound together and before the country finds its true equilibrium many changes will probably occur.

As a city Rio de Janeiro has been so well and so often described that I shall only give here the briefest outline of a few points of interest as they impressed us. The houses are all of stone or brick, rarely more than two stories, built on an irregular hilly surface, mostly facing the ever visible and always enchanting inland sea, the harbour. The rear of the city is lost between the rising hills which encircle the harbour. The streets are very narrow, are paved with granite, and are always alive with people of several colors and of all nationalities. The business streets have an air of bustle and Yankee thrift, but the side streets are clothed in the usual perpetual ease of the tropics.

The city is easily traversed by electric and mule cars; even the mountains are ascended by electric and steam roads, which required great engineering skill in construction. Carriages and waggons are almost entirely drawn by small mules. The numerous sights and breathing places are reached without much trouble and very cheaply, for Rio has perhaps the cheapest carfare of the world, less than three cents a ride. Rent is nearly as high as in New York in the better or healthier parts of the city; wages are good, but living in general is expensive. Nearly all the foreigners, however, consider it an excellent business place. The health of the city is

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good, excepting occasional epidemics of yellow fever, and, if it were not for the intense heat of summer, Rio would offer a bright future for young, ambitious Europeans and North Americans.

It would hardly be expected that poleward-bent explorers would grow enthusiastic about any place in the torrid zone, but Rio de Janeiro, with all its heat, has people with warm hearts, who were to us a pleasant inspiration. It has fruits and coffee which are a joy to the inner man; it has abundant natural resources which will some day make it a great, a very great, city.

Saturday at 2 o'clock was set for the time of sailing, and although we appreciated the honors and pleasures conferred upon us by the hospitable Belgians and Brazilians, the appointed time found us all eager to continue our voyage toward the south pole. Many visitors were on board at the last moment. The Minister, with his fatherly interest in the expedition, the Belgian committee, representatives of the Rio Geographical Society, and various other distinguished visitors were there to bid us *au revoir* and *bon voyage*. Among the visitors were a couple of young ladies who received an unusual share of warm attention from the prospective frigid explorers. A desire to kidnap them as a diversion to break the long monotony of the journey was frequently expressed and no doubt deeply felt by at least one lonely bachelor. The last visitor was a young Brazilian in a gaudy uniform, who came by a special Government launch as a representative of the President. His particular mission was to offer us the President's compliments and his

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wishes for a good, successful voyage. This we appreciated as a delightful bit of thoughtfulness on the part of President Barros.

On board the *Belgica* everything was bustle and haste. Provisions were coming, new articles of equipment were being loaded and stored away, visitors were going to and fro examining our curious instruments and the general outfit. Tugs were all around the craft and one, with several photographers, kept spinning around, snapping at the center of curiosity from every side. At three o'clock the Commandant gave the order to start, and the entire mass moved with us. The visitors remained on deck, and the tugs followed.

The commercial part of the harbour, with its steaming heat and teeming mass of conglomerate humanity, soon fell behind more interesting points. Several foreign cruisers were in the harbour among them our *Cincinnati*, and these kept us busy replying to salutations and cheers. As we passed the old battered fort of S. João we rather expected a series of salutes, but instead a large band appeared on a low crown of torn cliffs playing lively airs. Now and then the musicians would stop and fill the atmosphere with quaint cheers, all of which pleased us far better than a display of powder.

As we advanced, a rather strong wind ruffled up an uncomfortable sea, and as we approached the narrows, which are guarded by two ancient looking forts, it was deemed best to part with our visitors. The Brazilian men hugged and kissed us, as is their custom—the men only, not the ladies. Our good friends of the Belgian Colony offered many cordial

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greetings, and as the tugs withdrew from us, the oft-repeated *au revoir* and *bon voyage* came with every leap of the sea.

Our progress against the incoming wind and sea was very slow, but this gave us an excellent opportunity to take a long parting view of the beautiful Bay of Rio de Janeiro, with all its indescribable splendour. The sun was low, close to the crests of a ridge of mountain peaks. We were steaming out of the mouth of the bay, a harbour which is said to be large enough to afford room for all the naval fleets of the world. On every side were mountains rising abruptly from the waving expanse of blue — mountains with cliffs and steep slopes, many apparently perpendicular, all with sides nearly covered by a thick dark green verdure. Only the loftiest peaks were bald and even these had a few weather-worn trees to add colour and life.

As we looked over the stern of the *Belgica*, much of the city was still in view. The low, irregular houses, with tiled roofs and sides washed with lime in various bright shades of red, white and blue, were unique and attractive. They will always remain in our minds as a pleasing reminder of Brazilian good wishes. Before the city and behind it were the perennial midsummer waters, spotted with vessels of various nations, beset by a score of emerald isles and fringed by as many fascinating bays. It is, however, the crude, rugged majesty, — the rare grandeur of the mountain peaks around the enchanting harbour which give it ever fresh and effervescent glory.

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Beginning at the left and close to the stern of the *Belgica*, was a bold peak of solid rock, which from its fancied resemblance to a lump of sugar, is called *Pão de Assucar*. A little farther on the eye is stopped by the famous Corcovado, a huge needle of granite, its base washed by the blue tropical waters, its apex, three thousand feet above, piercing soft, pearly vapours, and its sides painted by the hand of nature in various shades of green. Next upon the horizon was outlined the strange freak of nature, the *Bicodo do Papagaio*, or Parrot's Beak. A bit of landscape, more distant and less startling, but still very alluring, is next in line—the interfolding rock configurations of Gavea. Then several other sky-scraping mountains, and the enraptured vision ends upon the whitened crown of fair Santa Thereza.

Along the head of the bay, ever veiled by a blue haze, are the Organ Mountains, so named because the various cones and serrated peaks bear a fancied resemblance to the pipes of an organ. Beyond these, but out of vision, is Petropolis, the new capital of Brazil, and the summer home for Rio's wealthy and foreign residents. To the right are lesser mountains, separated by deep bays and broad, fertile valleys. The beds of these are clothed with banana, mango, pineapple, and other fruit-bearing trees and plants. The scene as a whole is a feast to the eyes and a nursery to the mind.

But we must be off to less fertile lands—on to the icy south, stopping only at Montevideo and the Strait of Magellan before we attack the virgin ice south of Cape Horn.

CHAPTER II

FROM RIO DE JANEIRO TO MONTEVIDEO

MONTEVIDEO, November 13, 1897.

THE *Belgica* left Rio October 30, 1897. She steamed out of the harbour amid an uproar of salutations and accompanied by many of the friends of the expedition to the entrance of the bay. Here the little party of well-wishers gathered around Count Van den Steen and offered us a final *bon voyage*—a scene and a sentiment which followed us far into the polar night. The sun was hanging low over the blue outline of the Organ Mountains, and the darkness of the rapidly approaching tropical night was already on the lowlands, which are here exposed to receive the warm humidity of the Atlantic. The wind was steadily increasing from the east, bringing in a heavy sea and premonitions of an uncomfortable night. The two battered forts which guard the entrance were soon passed, and we laid our course south-westwardly along the Brazilian coast, with a fair wind and a favourable current. Darkness, torrid blackness, settled down over us with a rapidity which I had not before noted. The wind increased and the sea rose higher and



Rio Harbour from Mt. Corcovado.



Rio de Janeiro.

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higher, bringing with it Neptune to salute the too hilarious victims of the expedition at Rio.

The next morning no land was in sight, but the weather was delightfully clear with a fair breeze and an easy sea, a happy condition which followed us several days. We have now passed the tropic of Capricorn, are out of the torrid zone, and well on our path across the south temperate zone toward the bottom of the globe. The air is more stimulating, the winds fresh and bracing, more in accord with our polar longings, and altogether we begin to feel our natural vigours and ambitions which the burning heat farther north had withered.

From Madeira to Rio it had been found impossible to sleep in the bunks because of the stifling heat. Hammocks were accordingly swung amidships, in which some sleep was possible for the occupants of the cabins, while those of the fore-castle stored themselves on the deck in almost any position offering a breeze and a protection from being washed overboard. These restful open air positions offer a splendid opportunity during the sleepless hours to study and admire the beauty and strangeness of the southern sky. From the time when we crossed the equator to our present position we have been intensely interested in the new constellations which have glided over the southern horizon, while in the north we have been watching, with some regret, the sinking and disappearance of the stars and groups with which we have been familiar from the time of our infancy. This vanishing of the Pole Star, and the many old friends in the heavens

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brings to us a vivid impression of the vast distance which we have traversed from our native lands. The new firmament has many charms, but it takes time to admire its complex splendour. The grouping of the large stars, the scattered nebulae rivalling in lustre the Milky Way, and the unfilled spaces, remarkable for their extreme darkness, give the southern heavens a peculiar aspect. With this dome of tropical blue relieved by the new heavenly bodies above, and with a breakneck pitching and tossing at every plunge of the vessel, one is more apt to fall into an admiration of Nature than into a profound sleep. But this easy life on deck has also its drawbacks at times when one's calm, dreamy philosophy is suddenly and rudely interrupted. Jack runs across the deck and presently stumbles in a heap over some sleeper when a series of grunts and something worse fills the night air with another spirit.

On November fourth, for a short time, the low shore-line of the Island of Santo Catherina was dimly visible under a blue mist in the west. At about this time we also saw the first Cape pigeons, stormy petrels, and albatrosses, and a few days later when there was no land in view an off-shore wind brought us some forms of land life. Among these were butterflies, moths, various birds with beautiful plumage, and some troublesome flies. We met only one voyager on this lonely course, a Brazilian coaster. She was built after a model of the last century, but, having every rag set which could draw, she came through the rolling blue waters with a grace and picturesqueness that would do justice to a modern

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yacht. We enjoyed the sight immensely as she came towards us, ploughing through hills of foam, her blunt prow buried in white spray, her huge square stern rising and falling nimbly out of one trough into another. It was as if one of the explorers who had gone before us, a Drake or an Anson, who were at once pirates and explorers, had suddenly dropped in our path to examine the men and the methods of less ambitious followers.

On the evening of the seventh we were fascinated by a strikingly beautiful sunset—the first worthy of note since the *Belgica* left Antwerp and certainly the most remarkable which I had observed since leaving New York. The phenomena was most charming in colour when the sun was about to sink behind the blue outline of Uruguay on our western horizon. The sea was branded by streams and bands and spots of fire which, with the easy undulation of the surface, gave it the appearance of active flames. The sun itself was descending behind a faint purple zone of mist. Its disc seemed out of all proportion to its usual size and there was something sublimely beautiful in the loneliness of its descent. All the sky above it, and far to the south and north was a vivid crimson in zigzag streamers, while over our heads the dome was an exquisite tint of green, which melted in the east into a dark purple blue. Shortly after the heavenly glow of the sunset had vanished, the sky began to assume quite another aspect. A gloomy range of cumulus clouds rose in the northwest, and in a few hours had advanced so far as to project nearly over our heads.

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The scene was made particularly strange by the even steely colour of the rest of the sky. It was ruled with a line, here and there ragged, but for the most part singularly homogeneous from the confines of the north-eastern mass of horizon. All the central portion of this vast surface of cloud was of a deep leaden hue, while its edges were marked by rapidly changing lines of carbon and luminous grey. By a deception of the eye the entire mass appeared convex, and it looked as wild as any phenomena of Nature I ever saw. At frequent intervals a sharp shower of arrowy lightning whizzed along its lowest fringe, illuminating the decks and the sea with a weird blue light. The lightning had the remarkable peculiarity of not being accompanied by thunder, nor was it followed by rain.

Yesterday at noon the high ridge of mountains in the eastern part of the province of Rio Grande do Sul were feebly discernible under the western horizon. This is the most southern province, the most industrious, and certainly the most promising part of Brazil. It is composed almost entirely of Germans, upon whom the unfair yoke of the Rio Janeiro government fits badly. They are at present engaged in a revolution for freedom and independence. To-day we have the low sandy dunes of the coast of Uruguay on our port side, and through the night we made little progress against the increasing southerly wind which followed the peculiar sky effects. At 6 o'clock on the morning of the eighth, we were off Castillo Island. Here the wind increased with such fury that we began to look about for a harbour.

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In a few hours we were off Cape Polonio, but a farther progress into the mouth of the River Plata against the wind was impossible. The bark was turned landward for a little cove at the neck of Cape Polonio which seemed somewhat sheltered by the off-lying seal rocks. To reach this anchorage, however, the bark made difficult work of it. She rose and tumbled over the ugly land swells like a waggon over a rocky road. Her feeble engines were pressed to their greatest force, which heated the spaces above the fireplace to such an extent as to ignite the woodwork, and thus to the anxiety of the storm was added the excitement of a fire.

The fire was soon extinguished, and at noon we dropped anchor in a little harbour where the main force of the wind did not reach us, but the sea continued to rise and fall with a sickening suddenness. Here we rode out the storm, which continued until about noon of the next day. The falling of the temperature, caused by the decreasing latitude and especially by this storm, is daily more noticeable. Already the cold south temperate winds have compelled us to abandon the restful open air berths in the hammocks and driven us into the stuffy state-rooms, where every precaution has been taken to prevent the escape of heat in the icy south. During the afternoon and night, while the ship was bowing to the wind and violently pulling at her chains, we examined the character of our surroundings. From our position the land presented about as barren and lifeless an aspect as any region I ever saw.

On closer inspection we became interested in the mere bleakness, and little by little we found a fascina-

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tion in the lifeless sterility with which we were first impressed. The torrents of wind moved the sand-like snow, and even deposited it in huge drifts, giving the whole surface a wavy, undulating appearance. In the interior a few ranges of low hills were discernible; but their surfaces were such that the shape could not be easily separated from the vast wavy plain along the coast. Cape Castillo is easily distinguished from the other sandy points by a white round sand hill, one hundred and eighty-four feet high, to which the land gradually rises from the Cape southward. This is Mount Buena Vista, and its peculiar mammary form, with its well defined white nipple and rounded sides marked by dots of cactus plants,—these peculiarities, with the isolated position, give the eminence an impressiveness and a picturesqueness quite in accord with its important geographical position.

Mount Buena Vista marks the entrance from the north into one of the largest and, for the future, one of the most important rivers of the world, the Rio de la Plata. The river was discovered in 1515 by Juan Diaz de Solis, and seems to have been named by Sebastian Cabot in 1520. The name (meaning “river of silver”) was not given it because of its fancied resemblance to silver-plate, for in reality its surface is always ruffled, and its colour and consistency would be better described by the “river of mud;” but the great amount of actual silver ore which was taken from the Indians along this river, and the fact that it was used as a highway for the transport of the metal to the coast, are

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responsible for the poetic name of this ever dirty stream.

Though the waters are not sparkling, and the banks are not such as to call for an enthusiastic description, yet the Plata occupies a position unequalled among the rivers of the world. It drains the largest part of South America south of the Amazon basin, and with its many tributaries reaches from the mountains of eastern Brazil to the Andes, covering therefore almost the entire width of the continent from the Atlantic to the Pacific. While its basin is thus widely spread, the name Rio de la Plata is limited to the stream from the junction of the rivers Parana and Uruguay, to the Atlantic. It is one hundred and fifty miles in length, and about one hundred and twenty miles wide at its outer spread. From here it rapidly narrows, so that at Montevideo it is but fifty miles wide, while at Buenos Aires it is only twenty, and at the junction of its principle head waters, but four miles. Its peculiar water is generally noticeable far out in the Atlantic by the change in colour: from the bright blue of the subtropical seas to a dull green, and on closer approach to a dark brown.

One of the most remarkable facts in the history of American discovery is the slowness with which the world has learned of the true natural resources of this region. The early Spaniards came here to obtain from the Indians, either by fair means or otherwise, such valuables as they possessed. Silver and gold were thus secured, and this led to the more important discoveries of the sources of these

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metals, which we now know are so widely spread over the continent. Little by little the Spaniards settled among the Indians; and then came a time when the English descended upon the Spaniards and relieved them of their treasures. One of the first of these British pirates was Sir Francis Drake, knighted and otherwise honoured by Queen Elizabeth for his heartless cruelty to, and valuable thefts from, the Spanish pioneers.

Drake's narrator, while writing pious words with one hand and stealing Spanish silver with the other, had not much time to make sharp observations, but his notes are interesting. "Passing thus," says the Reverend Mr. Fletcher, "in beholding the excellent works of the Eternal God upon the seas as if we had been in a garden of pleasure, April 5, 1578, we fell in with the coast of Brazil, in $30^{\circ} 30'$ towards the Pole Antarctic where the land is low near the sea, but much higher within the country, having in depth not above twelve fathoms three leagues off from the shore; and being deceived by the inhabitants (Indians), we saw great and huge fires made by them in sandy places. After this, we kept our course sometimes to the seaward, sometimes to the shore, but always southward as near as we could till April 14th, in the morning, at which we passed Cape St. Mary which lies in $35'$ near the mouth of the River Plata running within it, about six or seven leagues along the main, we came to anchor in a bay under another Cape which our General afterwards called Cape Joy. (The present site of Montevideo.) The country here about is of a temperate and most sweet

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air, very fair and pleasant to behold, and, besides the exceeding fruitfulness of the soil, it is stored with plenty and mighty deer." A few months later the good Reverend wrote thus: "We lighted on a Spaniard who lay asleep, and had lying by him thirteen bars of silver, weighing in all about 4,000 Spanish ducats. We freed him of his change which, otherwise, might have kept him working."

Since this time the Spaniards have slowly spread and mingled and intermarried with the Indians, and the various resulting states have secured the independence of the Castilian yoke and are now very rapidly advancing. But for the first two centuries progress was very insignificant. Buenos Aires, the New York of South America, is here spreading on the banks of the silver river. Montevideo and other cities are growing with a vigour similar to that of Yankee towns, and if excellence of climate, fertility of soil, and limitless natural resources count for anything, the gathering basin of the Rio de la Plata will certainly soon become the United States of South America.

We went ashore on November 9th, and were met by a weather-worn group of men in various quaint costumes. Their faces and their apparel did not suggest the pleasureable moments and the warm reception which fell to our lot later. But we soon found hearts as warm and minds as appreciative as any that could be discovered under silks and broad-cloth. Cape Polonio is a port of anchorage, about two miles southward of Mt. Buena Vista. On it is a lighthouse of gray masonry, one hundred and thirty-

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seven feet in height, with three white horizontal bands. The actual height of this tower is not great, but being placed in a region where the sky is constantly loaded with clouds, and over a land with little irregularity of surface, the white peak seems constantly to pierce the dark skies. Scattered about on this neck of land are a few huts made of the remains of wreckage, galvanised iron, or grass, according to the luck and wealth of the various occupants. To the most palatial of these we were first escorted.

This was the home of the proprietor of the only industry of the place,—a sealing station. We had at first some difficulty in making ourselves understood. There was no one among us speaking Spanish, but after a brief effort we found that a little French was understood and that English was possible with an old seaman. At the lighthouse an Italian speaking French fluently came to our rescue. We had no special object in making a debarkment here, but since the storm drove us into shelter the staff of scientific collectors determined to examine the nearest ground. The zoölogist, with his assistant, searched the shore for shells and marine life; the geologist went to examine the sand-dunes, while the surgeon remained to administer to the wants of the natives, from whom some prized ethnographic specimens were obtained. The earlier Indian tribes, which once roamed over this region, like those of the coastal regions farther north, have entirely vanished. There are no trees nor is agriculture in the immediate vicinity possible. A few

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cactus plants are the only green spots which cheer up the dull white sands. But a short distance inland there is excellent grazing, and here are found some of the most magnificent cattle farms of the world.

After our collecting tour we assembled at the home of the chief sealer. Here the customary native hospitality was extended to us with open arms. The women prepared *maté*, the South American tea, while the men brought out their most precious varieties of alcohol and cigarettes. The good people of the entire encampment, about fifty in number, then assembled to do us honour. Among these there were a few *gauchos*, the South American prototypes of our own cowboys, and two or three travellers en route to Montevideo from Rio Grande do Sul; all the others were engaged in the various departments of sealing. They had taken many seals the year before, and 16,000 during the previous season, all of these from the rocks which surround the cape. The seals are of a common variety, yielding oil and leather but no fur. As we departed we were loaded with presents and treated and toasted again with *maté* and brandy, ingredients as necessary to South American hospitality as whisky and cigars to the success of an old time political meeting in the United States.

At four o'clock on the morning of the tenth, we tipped our anchor and drew out of the little harbour, steaming into the Plata, close to its northern bank. Throughout the day we had the low sandy beds of Uruguay on our port bow. On these there was an

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occasional group of cactus, but they seemed from a distance like projecting rocks and, aside from the relief which they afforded, there was nothing to break the monotony. It was one long, nearly level bank of lifeless sand. In the back ground an occasional row of blue hills marked the position of a warm and more promising country.

On the morning of the eleventh the scene had noticeably changed. We had passed Cape Maldonado during the night and were heading for Flores Island in a direct course for Montevideo beyond. The land no longer presented the sterile sand-driven beach, but gray wind-rasped hills, separated by patches of forest and fronted by prominent highlands which stood out boldly against a clearing sky. The temperature rose quickly as we advanced into the river. We passed Flores Island at two o'clock, and dropped anchor in the horseshoe bend which forms the imperfect harbour of Montevideo.

We had been met farther out in the stream by the customs and quarantine officers, but these troubled us little, and were of much less interest to us than our third visitor, the congenial representative of the Belgian Consulate, who brought our letters and some news of interest. To us the most startling news was the story of the bold attempt to assassinate President Barros of Brazil, whose friendly hand we had shaken only a few days previous, apparently surrounded by all possible guards to perfect safety. This case, however, while somewhat startling to a stranger, illustrates one of the recognised methods for changing presidents in the Spanish American republics. The

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President of Uruguay was summarily disposed of in the same manner only a few months ago, while his successor is probably awaiting his turn with resigned fate. The life of a president hereabout is evidently not one of any special ease, security, or comfort.

The city of Montevideo presents, even from a distance, an air of thrift, wealth, and comfort. El Cerro, a nipple-shaped mount, is the only distinguishing feature of the landscape which marks the sight of the port. It rises in a gentle slope to the height of five hundred feet, about a half mile from the rugged beach on the western side of the bay. Its sides are covered with a thin grass which is now giving place to residences, a result of the recent growth of the city. The top is crowned by a fort, and within this there rises a splendid lighthouse, whose powerful revolving light is visible at sea twenty-five miles from the coast. The main portion of the city stands upon a peninsula of gently rising ground on the east side of the bay. From here the town spreads over a large portion of the mainland and there are several prominent buildings which stand out boldly over the low houses which compose the body of the city. To one coming from Rio Janeiro or other cities in the tropics, the most noticeable feature of this city is the dense volume of smoke arising from its chimnied houses and thrifty factories: the latter are a certain sign of an agreeable climate and dry apartments—comforts foreign to torrid America.

It was, perhaps, eight o'clock in the evening before we had finished reading our letters and were ready for a debarkment. The afternoon was fairly

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clear, there had been little wind, and the temperature was extremely agreeable; but now the aspect changed with such suddenness as to cause some anxiety for the ship's safety during the coming night. Huge fantastic rolls of lead-like sheets of clouds drove rapidly over the sky from the west, and painted the whole scene in an inky blackness with such marvellous speed that we were amazed and undecided as to what it meant for some time; but a few zigzags of coloured lightning and a deafening burst of thunder soon explained to us the character of the coming commotion. Thinking that we could reach the shore before the shower commenced, we descended into one of the tugs, which at once headed for one of the many lights standing out boldly in the inky blackness shoreward. But on our way we were pelted and pounded by such a hail storm as had never fallen to my lot. The globules were about the size of a large marble, and fell in such numbers that, though the fall did not continue more than ten minutes, it completely covered the decks. As we reached the shore, and mounted to the pier with our hats battered and our pockets full of icy spheroids, we had to face still another trial characteristic of the Plata, a rain storm. But this rain storm while interesting from a meteorological standpoint did not arouse us to a sense of study. Big drops came quickly in the wake of the hail pellets, and these multiplied with such rapidity that in a few minutes, and before we could find shelter, it seemed as if all the clouds of heaven had united to pour upon us a cold torrent.

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Drenched as thoroughly as if we had been overboard, we shortly found our way to the Hotel Oriental, and here the entire upper floor was placed at the disposition of the members of the expedition. After a comfortable night's rest and a cup of delicious Rio coffee brought to our bedside—a custom which is everywhere in South America a joy—we prepared for a material study of the city and its resources.

San Felipe de Monte Video is the full name of the capital of the Oriental Republic of Uruguay, but it is now generally written Montevideo. It has a population of about 200,000, and of these it is said that not less than 50,000 are foreign residents. The entire Republic has a population not exceeding 800,000, hence one quarter of Uruguayan residences are here closely huddled together near the mouth of the Plata. The blood of the Uruguayans, aside from the complex European admixture, which is now entering their veins, is a curious blend of old Spanish and local Indian. But unlike similar hybrids many of the good qualities of the bold Spaniard, and of the freedom-loving Indian have been preserved. Hence the men have developed into a type of vigorous manhood giving an appearance at once of wild strength and refined intelligence, while the women must be considered as among the most beautiful of the world.

The trade of Montevideo seems far beyond what we would expect from a town of its size. Wool, hides, tallow, dried beef, and, in general, the products of cattle farming are the chief and nearly the

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only exports. But these are gathered from the interior in such tremendous quantities, and with so little expense, that they form an enviable source of wealth ; and since this is also one of the chief exports of the United States, it is evident that Uruguay is to us a formidable commercial rival. The imports are very large, because this is a centre from which much of the country in the Plata basin is supplied. The imports consist principally of cotton, woollen and silk fabrics, hardware, wine, various food products, and, within the past few years, much improved machinery has been bought. The trade is almost entirely with the various states of Europe, of which England claims twenty-five per cent. The means of transportation to the United States is so imperfect, and the efforts of our merchants have been so feeble that Yankee goods are little in evidence here.

From our balcony at the hotel we had a charming view of the city and of the bay which forms the harbour. Twenty-seven steamers of huge tonnage were anchored at various points, mostly far from the shore. A little nearer were a series of cruisers from various nations. Among these was the beautiful little *Castine* of our White Squadron, and *H. M. S. Retribution*. Still nearer were a large number of flat-bottom river crafts, which navigate the Parana and Uruguay rivers. The harbour thus presented every evidence of thrift and industry, while the many large warehouses fronting the water were sufficient proof of the great commerce. The city is composed mostly of tile-roofed two-story stone houses, neat in

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appearance, and comfortable in equipments. The law prohibits the building of private residences more than seventeen metres in height. But there are many public buildings which are raised much higher, and notable among these is the imposing structure which now belongs to the University of Montevideo. It was originally built as a hotel, but was finally bought by the Government as the home of its principal institute of learning. The building occupies a good sized square, is five stories in height, and has a wide open centre with balconies on every floor. The institution has excellent laboratories, libraries, and is in many ways well adapted for modern education. It is thus a proof of the noble and higher aims of our little sister Republic.

Closely connected with the University is the growing fame of a young Italian bacteriologist — Dr. I. Sanarelli. Two years ago Dr. Sanarelli accepted a position on the staff of the Institute of Hygiene, and in addition to his regular work he has devoted much of his time to a careful search for the germ of yellow fever. His efforts seem to have been crowned with success, for he is to-day the most noted man in all South America. I heard the name of Dr. Sanarelli on every tongue from the Amazon to the Plata, and I expected to pay him a formal professional visit, but this was obviated by a more natural meeting. We were taking dinner at the one fashionable restaurant of the town when the famous doctor came in, and he was promptly ushered to our table.

The story of the discovery of the germ of a

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disease which has destroyed thousands, perhaps millions, of human lives, is a matter of considerable interest and certainly vastly more important than that of a king who has conquered nations. And if this discovery is supplemented by a remedy which will cure or prevent the disease, it will surely be one of the greatest blessings which the world has ever known. Both of these attainments seem to be within the grasp of Dr. Sanarelli. During the early part of the present year (1897) he discovered the little organism which is the cause of the yellow pest. The news has spread over the entire world, but with the usual conservative attitude of the medical profession the brilliant discovery has been but slowly recognised; even at present there are many doubters who will not accept the newly discovered organism as the sole cause of yellow fever until confirmatory observations establish the fact more definitely. The Montevideo doctors, however, one and all, accept the discovery as final and look with confidence to Dr. Sanarelli for the practical outcome of the curative plan of treatment upon which he is now experimenting.

To cure yellow fever with its cause in hand, it is proposed to make a fluid similar to the anti-diphtheritic serums, which are either destructive or inhibitory to the germs in question. Such a serum has been made and it has been tried upon beasts and men with what Dr. Sanarelli considers marked success. The Brazilian government, in whose domain there is always a nursery of the disease, has recognised the great possibilities of this work, and

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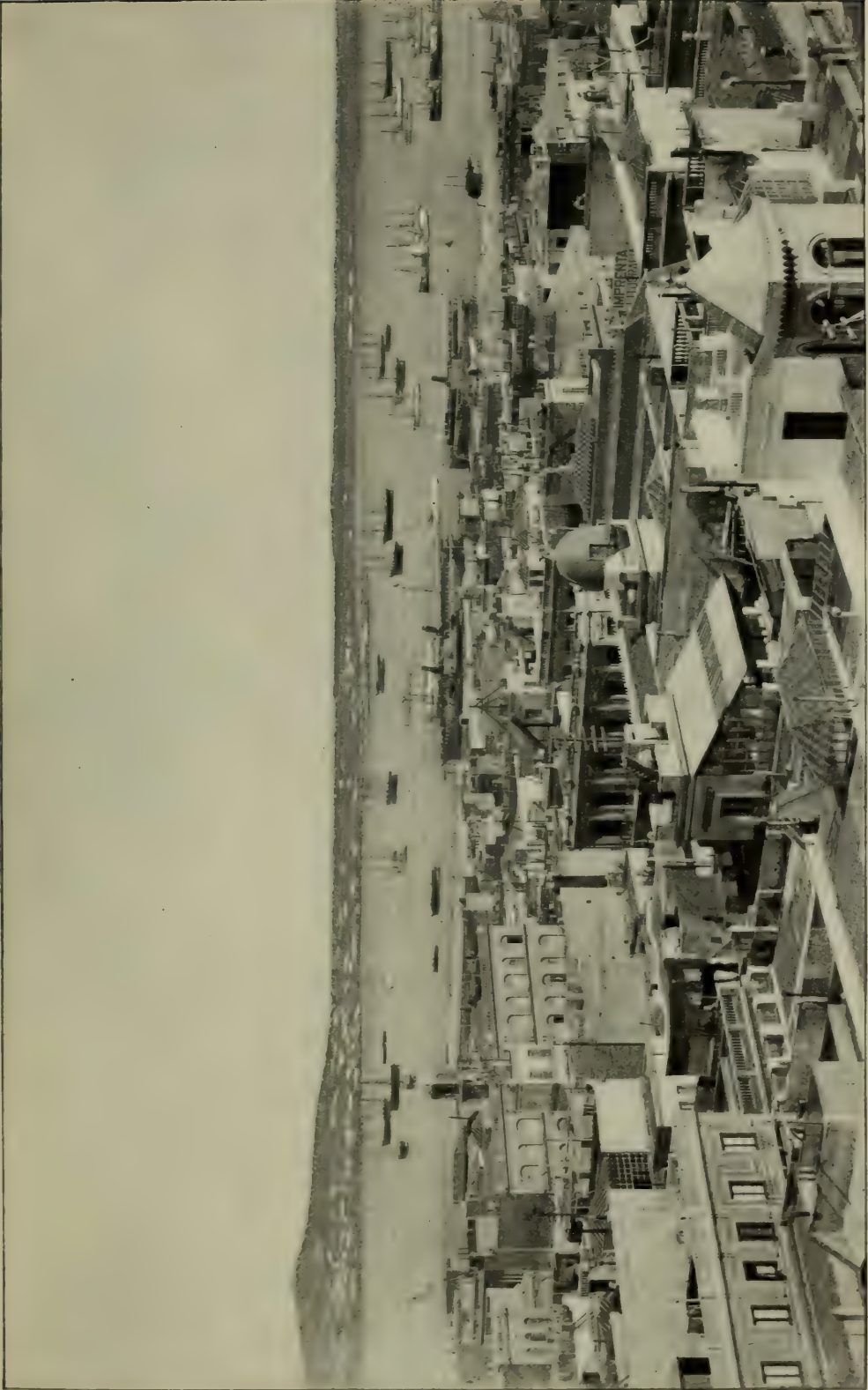
will shortly set up an experimental laboratory for the manufacture of the serum. For a positive judgment as to the success or failure of the serum plan of treatment we must wait for a long trial, perhaps several years ; but the glory and the credit of being the first to see in this dangerous little speck of life, hitherto invisible, an enemy which has caused the death of uncounted thousands of vigorous human lives, already belongs beyond a question to Dr. Sanarelli.

Our time at Montevideo was spent in collecting articles of equipment, provisions, and general supplies, for the use of the expedition in the icy antarctic. For this purpose the city affords many advantages, since nearly all foreign goods can be obtained at very moderate prices, and the local production of fresh provisions are both limitless and cheap. Under the guidance of our thoughtful Belgian friends, we were offered every facility to enjoy the warm hospitality of the place, and to accomplish quickly the objects of our visit. And although we were anchored here less than three days, we were able to complete our mission, and see a few of the local characteristics. The stores are everywhere well stocked with domestic and foreign goods, and if the buyer is able to speak English or French he will have little difficulty in being understood. The streets are wide, regular, and well paved with granite blocks. Tram-ways afford ample but slow transit. Carriages are numerous, and can be obtained at a very moderate cost. Somewhat irregularly scattered throughout the city are small parks with neat arrangements

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of tropical and semi-tropical plants. The greatest attention, however, seems to be given not to flowery decorations, but to the systematic adjustment of wide promenades.

It does not take a party of young bachelors, such as the "personnel" of the *Belgica*, very long to discover the side of life with which these promenades are always closely related. Indeed, we soon found out, without assistance, the reason for their great width in proportion to the size of the park—a cause which was to us a never-ceasing pleasure. For we all arrived independently at the conclusion that this feature of the city must be due to the remarkable number and variety of strikingly beautiful women in Montevideo, and their desire to display their qualities to male admirers. So far as my limited experience goes, there is no street or promenade in the world which can offer so large a number of charming young women, in a given group and in a given time, as these palmy promenades of Montevideo. We found it difficult to assign a tangible reason for this attractiveness. It was not in the dress, for the costume was that of nearly all the civilised world. It was not in the form, in the colour of the hair, in the carriage, or in any noticeable art of manner; for all of these characteristics were comparable to those of the refined women of New York, Paris, or London. But in addition to perfection in all these matters there was about them an indescribable something, which made every woman on sight appear to be able to speak her own ideas and the meditations of her admirers in the tongues of the



Part of Montevideo.

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observer, be he French, English, German, Spanish, or what not. Perhaps we were too much absorbed to have discriminating powers; but for this we should be pardoned, for it was about the last glance we had of women, beautiful or otherwise, during four hundred long, wintry days.

The most prominent citizen of the United States in Uruguay is a modest Bostonian of whom we hear little at home, but who is well-known throughout South America. It is Mr. Thomas W. Howard, who has enjoyed the unparalleled distinction of being a consular representative of the United States for nearly thirty years. The force of character, the executive ability and faithfulness to the home Government, necessary to retain such a position through all the political upheavals, must be evident to every one. The fact is, that Mr. Howard has performed his duties so faithfully, and is such a favourite at once among his countrymen and the Uruguayans, that a change has been found to be undesirable by both the Democratic and Republican parties. Mr. Howard's residence is one of the bits of local architecture which is much discussed and admired. It is situated in the most fashionable part of the town, on the border of a small but luxuriant park. Its external appearance is not extraordinary in either size or loveliness, appearing simply as a substantial structure of bright sandstone with two stories, but the interior displays wealth and artistic taste. Here expensively polished marbles, rare antique furniture, and tasteful decorations are everywhere in evidence. It is the home of a cultivated and refined man

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of the world, amid the boundless South American luxuries.

It is impossible for me to give in this limited space the various phases of interesting life in this merry Paris of South America, so I will close with a few general impressions: First, Montevideo is a city of uncounted natural wealth, for prosperity is stamped on the blocks of every street, on the modest but comfortable homes, on the stores, the hotels, the clubs, and the churches. Second, it is a city of charming women, against whom I could bring but one indictment, that of disbelieving in their natural charms to such an extent as to lead them into a lavish use of artificial colouring and powder. Third, the enjoyment of life is here one of the prominent arts of daily occupation. Merry faces are always in evidence, and the light, airy laughter of both sexes bursts with the ease of soap bubbles. Deep meditation, curbing, or melancholy cares, and profound inspirations are usually out of sight. Among Uruguayans life is indeed a happy, leaping, bubbling stream.

CHAPTER III

ORGANISATION OF THE EXPEDITION

OFF CAPE VIRGIN, November, 29, 1897.

QUITE as interesting as the work of an exploring expedition is the story of the initial inception of the idea, and the various experiences, fortunes and misfortunes of its projector. The difficulty of Columbus in securing the necessary funds for his bold voyage across the unknown waters of the west are familiar to all. A similar difficulty has fallen to the lot of M. de Gerlache and every explorer who, even in the modern days of progress and scientific enlightenment, has tried to secure the necessary funds for a voyage of scientific exploration. When an area equal to one sixth of the known land surface of the globe still remains unexplored, it is easy to formulate plans for journeys of discovery ; but to secure the money for their execution is quite another matter.

The ambition for antarctic exploration in Lieutenant de Gerlache's mind is an old story. "Exploration in general," he says, "and antarctic exploration in particular, has always had for me a particular fascination. When Professor Nordenskjöld announced

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his project for south polar exploration in 1892, I at once volunteered, but this, like many other projected southern expeditions, never materialised. The disappointment, however, only sharpened my ambition as did every one of my many subsequent discouragements."

In 1894 Lieut. de Gerlache presented his first paper to the Royal Geographical Society of Brussels. It was the prospectus of this expedition in its infancy. In it he made as strong a plea as possible for aid to promote exploration of the long neglected antarctic. The Society approved of the project, but offered, at that time, no financial assistance and even delayed its moral support. Various men of wealth were then appealed to, and after many disheartening disappointments, he enlisted the interest of M. Solvay, a promoter of science, "and with him the first glimmer of success dawned upon the horizon of the enterprise which was the 'apple of my eye'—the projected Belgian Antarctic Expedition."

Mr. Solvay laid the foundation of the fund with 25,000 francs, or \$5,000. In addition, he generously furnished the money for a visit to the arctic regions, a necessary preliminary schooling for an antarctic explorer. A leave without pay was obtained from the Navy to promote the germinating interests of the coming expedition. In the early part of 1895 Gerlache went to Norway, and with the Norwegian sealers to Jan Mayen and to the East Greenland waters. Here he studied the life of the sealers at work, their methods, and the strange animal life. He studied the elements of ice navigation, and above

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all, caught the never-dying fascination which enraptures every intruder into the white boreal regions.

On his return from the Arctic Sea, the expedition had assumed a more definite shape; the plan was matured, and definite arrangements were at once instituted. A prospectus was sent to King Leopold with a request for an audience, but it was refused. Gerlache then wrote a series of five articles, calculated to awaken interest in south polar regions. These were published and given much prominence by *L'Indépendance Belge*. The articles, with the warm support of the press, aroused the needed enthusiasm, and created the welcome public sentiment which carried the project to its final issue.

The Geographical Society, on its next meeting, at the end of January, 1896, opened a subscription list, but the fund swelled slowly. With the assistance of regimental festivities, cycling contests, exhibitions, and the help of various special committees throughout Belgium, 120,000 francs (\$24,000) were realised. The Government was then appealed to, and it responded with a grant of 100,000 francs (\$20,000). The total sum was now \$50,000. The road to success now seemed very easy, but other and unexpected troubles followed. The \$50,000, with the greatest economy, did not suffice for the many unlooked-for contingencies.

Active preparations were begun early in June of 1896, though it was hardly expected that the expedition would be able to start during that year. Gerlache went to Norway, and there bought from Captain Pedersen the *Patria* according to a pre-

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vious agreement, patriotically rechristening her *Belgica*. She seemed to be about the only ship of the Norwegian ice-fleet at all suitable for the expedition, and even after she was secured Lieutenant de Gerlache had to arrange with Mr. Christensen of Sandafjord to put in a new boiler, and to make other necessary alterations and repairs. At about this time, also, definite arrangements were made with several of the prospective members of the expedition—Messrs. Arctowski, Danco, and Amundsen were enlisted in the project. In spite of many minor discouragements, the prospects now really seemed bright; the expedition, it was felt, would surely embark. But Gerlache was then again delayed, though undaunted, by finding that the fund at his command was not sufficient to properly equip the expedition.

The final preparations of the vessel, the purchase of the scientific instruments, many of which were specially made, the want of ready money, and a thousand little matters which needed attention combined to delay the expedition. In addition to these drawbacks, other scientific men were necessary to complete the staff. Special efforts were put forth to secure a competent zoölogist, one who possessed qualities essential to a polar explorer, and this proved one of the greatest difficulties. Belgium and France were searched without avail, and finally Mr. Racovitza was found in Rumania. But he was doing military duty, and it was feared that the diplomatic arrangements essential for his release would be slow. However, he was luckily freed at once to join the growing family of pioneers.

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For south polar exploration it is necessary to leave the northern hemisphere in July or August. For it should be remembered that the seasons in the south are the reverse of those of the north. January is the midsummer of the antarctic. The vessels which are fitted to withstand ice jamming are slow. The heavy cumbersome timbers, the blunt bow, round bottom, fuel-saving engines and small canvas, are all excellent for ice navigation, but they are decided impediments to speed. The first of September was now at hand, and painful as was the thought of a year's delay, it proved unavoidable.

Lieutenant de Gerlache was in close communion with Commander Wandel of Copenhagen who had charge of the Danish East Greenland Expedition. This expedition in its scientific aims was more like the prospective Belgian Expedition than any other venture, and furthermore Captain Wandel was familiar with the United States exploring ship *Blake*, which had done splendid work in ascertaining the depths of the Pacific. "From Commander Wandel," says Gerlache, "I obtained not only valuable data, but much of his equipment at a nominal cost." In this way the end of the summer was spent in Denmark, and in a similar way the winter was spent in Norway.

To visit Dr. Nansen, and to prepare himself more thoroughly for the antarctic, Gerlache made his home in Norway during the early months of winter. For a like reason Lieutenant Danco accompanied him; they learned to travel on *skis*, and experimented with sledges, winter clothing, and camp

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equipments. The best possible outfit was selected for the intended sledge journeys over the virgin south polar lands. Many condensed and preserved foods, admirably adapted for polar journeys, are best obtained in Norway. From this experience it followed that most of our provisions were Norwegian.

Returning from Norway with the *Belgica* early in July 1897, he found that all the money was spent, and still he needed many, very many, important things. "Again," says Gerlache, "I sought aid by private subscriptions, and again we were doomed to disappointment. We now decided on a desperate effort. It was to arrange a public exhibition of the *Belgica* and its entire equipment, and either raise the additional financial support, or sell the whole outfit and abandon the project. The exhibition was very largely attended by the best people of Belgium, a fresh interest was created, and a new patriotic pride now arose in behalf of the expedition.

"A subscription feast was prepared, which, through the indefatigable efforts of Madame Osterrieth, became very popular and profitable. The festivities were held at a public park in Antwerp which was handsomely decorated for the occasion. Special military gymnastics and cycling contests were among the attractions, the attendance was large, and the welfare of the 'Expedition Antartique Belge' was on every tongue. The occasion won for Madame Osterrieth the title of 'Mother Antarctic,' and for the expedition ten thousand francs.

"Mr. Schollaert, the worthy Minister of the Interior, visited the *Belgica* as did many other deputies,

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and through them the Government was asked for another sixty thousand francs—an amount absolutely necessary to assure the successful issue of the expedition. This was granted, making the entire fund from all sources three hundred thousand francs, or about sixty thousand dollars. With this, preparations were at once made to leave Antwerp and the departure was announced for August 16th.

“Letters and telegrams with good wishes and friendly sentiments poured in from all sides at the last moment. But of these I can only mention a few :

“Captain Hovgaard of the Danish Navy, and a member of the famous Vega Expedition wired his compliments and ‘Good Luck.’

“Dr. Neumayer, of Hamburg, who has advocated antarctic exploration for twenty-five years wired : ‘My most sincere wishes follow you toward the south pole.’

“Fridtjof Nansen, whose star of fame had just risen, wired : ‘Chance and luck follow you and the *Belgica*. May the voyage bring such rich scientific results as the careful preparations promise, and may it throw a new light over the darkest part of the world.’

“We weighed anchor and drew out of Antwerp on August 16th. Many people gathered to see the starting, and all Antwerp seemed on foot to wish us *bon voyage*. Representatives from many French societies were there to congratulate us on our good fortune with the organisation, and to wish the expedition unbounded success. The yachts of the Ant-

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werp Yacht Club, under whose flag the *Belgica* sailed, showed their interest by salutations and a rich bedecking of flags. Amid the storm of cheers from the people on the quays, the tooting of whistles from neighbouring crafts, and the thundering of cannons from places which we knew not, we slowly withdrew. After a few hours Antwerp, with its friendly hilarity and its bustling activity, sank from view. Then, after a breath of ease and a moment of reflection, we felt that the hardest part of our work had been accomplished. At last the hard-earned project was afloat, and, as if to force the pride of our work upon us, the Dutch cruiser *Kartenaar* followed us out to sea in company for twenty-four hours, an indication of neighbourly affection which we keenly appreciated. This we afterwards learned was by order of the Dutch Queen Wilhelmina.

“Head winds, against which no progress could be made, and a small accident to the engine, made it necessary to put into Ostend. Here his Majesty, King Leopold, visited us, offering many congratulations on the success of the difficult task of organising the first Belgian polar expedition. His Majesty took a sharp interest in the *Belgica*, and closely examined her many peculiar fixtures, finally offering his hand and many words of warm encouragement befitting the occasion.

“During the few hot days of August, which were spent at Ostend, a teeming mass of fellow-countrymen and women crowded the decks of the *Belgica*. It seemed, with the vessel loaded so heavily, with every cubic foot of space occupied, and even the

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bunks and state-rooms piled full of useful articles, so that there was really no room for curiosity seekers, as if all Ostend, and a good part of the outside world, had been aboard. There came a time, however, when the ship must leave, when we must finally sever ourselves from the friendly atmosphere of our beloved native land, and leave our friends behind for the second and last time until our return."

It was on the eve of the final departure from home, by the way, that my own name was first suggested as a future companion. There had been considerable trouble and some disappointment in connection with the surgeons appointed. The first candidate was put aside, after acceptance, for personal reasons, and the second declined to go at the last moment for family reasons. Without a knowledge of this difficulty I cabled, volunteering my services, though at this time I had not previously written a line, nor was I acquainted with a single individual of the expedition, or its representatives. In response to my cable I received this :

IB H WH II OSTENDE, 10.45P (Via 369 Fulton St Brooklyn,
DR COOK,

BROOKLYN, N. Y.

FOUVEZ REJOINDRE MONTEVIDEO MAIS HIVER-
NEREZ PAS

GERLACHE.

To this I answered yes, and it was followed by, "Meet us at Rio, end of September." I had only a few days to prepare myself and my outfit for a journey which might take one year, or ten, or a lifetime. But

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I was determined to go, and so it came about that in September I found myself on the way to meet my prospective companions on the unfriendly bosom of the Atlantic, seasick and miserable from rough weather and tropical heat. I should have had a longer time to afford better means to prepare for a journey of this kind. To consent by cable to cast my lot in a battle against the supposed unsurmountable icy barriers of the south, with total strangers, men from another continent, speaking a language strange to me, does indeed seem rash. But I never had cause to regret it. The antarctic has always been the dream of my life, and to be on the way to it was then my ideal of happiness. To be on the way from it was an ambition quite as strong two years later.

Captain Lecointe describes the final departure and the voyage down the Atlantic thus: "There was a great storm of sentimental and serious enthusiasm as we left Ostend on August 24th. Fathers and mothers, brothers and sisters, and other men's sisters were there to press upon us their last tokens of love. This was done in different ways. Some cried, others laughed and took the matter in a good humor, and still others were angry that one of their number should, with eyes open, go from a warm home to what was predicted to be a certain icy grave. Many of the old seamen about gave gratuitous advice to our friends, based upon their own experiences about Cape Horn, which in substance was generally 'these men will never return.' As the *Belgica* drew out from the docks and we saw for the last time for

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many months the red faces of sadness, the pale faces of anxiety, the waving handkerchiefs, and as we felt the parting girlish kisses coming with the soft breezes, we were, indeed, half sorry to leave our little land of home delights. Amid the cheer of enthusiastic voices and the thunder of salutations from whistles and guns we glided out into the broad Atlantic, whose beating swells were henceforth to be our home and our highway to the chosen field of action, the snowy south polar regions."



The Belgica.

CHAPTER IV

THE "BELGICA," HER EQUIPMENT, HER COMFORTS AND DISCOMFORTS

STRAIT OF MAGELLAN, Dec. 2, 1897.

I HAVE now been on the *Belgica* more than a month, and my admiration for her becomes stronger as we advance toward the southern ice. Her history, her fittings, her equipment, and her men, all serve to enhance this affection, and every day I find in our good ship new points of interest. She has been dressed and redressed so much on this voyage down the Atlantic that the original owners would now hardly recognise her. She has been scraped and polished and painted, and rearranged inside and out, until she looks quite like a pleasure craft. Her new name, *Steam Yacht Belgica*, now fits her, for her aspect and atmosphere as a greasy, sooty sealer has vanished. The almost inseparable distinction of a sealing craft, the persistent fishy odour, is also gone.

The more we drive her over this lonely sea, the more we fix and comb and dress her, the stronger we feel her quivering animation. She already has a place in our affections as definitely as a pet horse. As she takes us farther and farther away from our

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homes, we become daily more dependent upon her. And as she pitches and tosses in the unruly seas, and rides out the forbidding storms, we feel we shall love her better. We may have become sentimental about our little pet, but so much depends on her. On the ability of the *Belgica* to plough through the virgin antarctic ice, depends our success in exploring the prospective new lands. On her hospitality depends our comfort, and on her stability depends, not only the success or failure of the entire expedition, but our future existence, for if she is buried in the antarctic, we cannot hope to survive, we must go with her to an icy grave.

To see the *Belgica* aright, and appreciate her real value, she should be observed in the polar ice, her natural home. In a cosmopolitan harbour, like Antwerp or Rio de Janeiro, among the larger ships and modern ironclads, she seems like a little bull-dog amid a group of large greyhounds—small, awkward, and ungraceful. In colour the *Belgica* is gray, with natural wood and cream trimmings. She is bark rigged, and has patent single topsails. Her body is one hundred and ten feet long, twenty-six feet wide, and she has a draft of fifteen feet. In a good wind, without steam, she is able to sail six knots. An auxiliary steam power is placed well aft, that the bow may rise to crush the ice. The boiler is new, and the engine has an effective horse-power of one hundred and fifty. Burning three and a half tons of coal, in Belgian bricks (*bricquettes*), and with smooth water, the *Belgica* will make seven knots per hour. But we shall only use her half speed, for with two

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tons of coal she will make about four knots, a speed quite sufficient amid icebergs, drifting floes, pack-ice, and unknown rocks.

There are many points of special interest in the construction of a modern steam sealer like the *Belgica*. But to describe all these would lead us into too many long nautical details. In selecting the framework of the bark, timbers were obtained of double the usual size and strength of an ordinary vessel of the same measurement. The stem was inclined, making the bow of an inclination similar to that of a sledge runner, which enables the vessel to rise on to the surface of the ice, and crush it rather by its own weight than by the motive force, as did the older ice-vessels. Otherwise the shape is similar to that of a well-built modern sealing vessel.

The planking inside and outside of the ponderous framework is of extraordinary strength, and over all is a special ice-sheathing of very hard wood. The bow and stern are protected by four-inch planks of greenheart, a tropical wood possessing the remarkable quality of being both hard and elastic. Experience has taught that this wood affords the best protection against the ice destruction. Amidships the wear is less, and here thick oak planks seem to afford the needed security, while it is much lighter and cheaper. The stern wall is five feet thick, and the breast wall about twelve feet in antro-posterior diameter. Outside of this almost indestructible battering ram, there is a protective sheathing of soft Swedish iron, to receive the first cutting edges of the ice.

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The rudder is large and specially strong to stand the strain of the crushing ice, while the vessel goes astern into the pack. The helmpoint is large enough to make it possible to dislodge obstructive ice. The propeller, too, has its special points of interest. It can be raised out of the water, as occasion may require, to free it from ice entanglements, or to replace it with a new one, should it be broken, and also to permit free sailing. And then there is the crow's nest — a huge barrel raised to the top of the mainmast, to enable the lookout to view a greater horizon. We shall often expect to hear, as I have in the arctic, startling news from the man in this sky-barrel. He will probably announce the first sight of some new lands, and will often send down a signal of our approach to some big animal, which will bring us all on deck armed with rifles, only to find a piece of discoloured ice or snow as a target.

If by any chance the southern ice-floes should hug us too affectionately, we are well prepared for its unwelcome caresses. Our little ship will stand a good deal of hard squeezing; she is constructed to fight not only with her engines and her armoured breast, but in her bowels we have stored something like two thousand pounds of tonite, an explosive said to be superior to dynamite for ice destruction. With this tonite we hope to blast and shatter and find freedom for our *Belgita* if embraced by the Frost King.

Although we do not expect to hunt seals or whales or anything else for commercial purposes, the expedition is well prepared to take all kinds of life for scientific study. We have boom and harpoon guns

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to capture whales and sea-elephants. We have rifles, shotguns, pistols, knives, and ammunition to do justice to a pirate ship. Several thousand pounds of alcohol, and a large quantity of chemicals are on hand to preserve animal specimens, and also cotton for stuffing birds, as well as an apparatus for blowing eggs. Our cameras are of all varieties, and with these we expect to photograph the strange antarctic life with its immediate surroundings.

The devices for scientific fishing are as complete as the limited finances would permit. We shall be able to fish on the surface in the middle stratas, and on the bottom of the deep sea. We can even scrape the bed of the ocean with huge dredges for low forms of life, and can drop the thermometer down to register the degrees of heat of the invisible homes of these strange creatures.

The trawls and dredges are made after the last American Sigsbee system as improved by Professor Agassiz. There are four large frames, fifteen nets, and three thousand fathoms of galvanised steel rope with a tensile strength of five tons to haul the catch by steam. And then there is the tangle-bar, and much other fishing apparatus, all of which would make an old-time fisherman stare with envy. In short, the equipment is such that not only the life of the air and land will be accessible, but also a systematic study of the marine life inhabiting the unmeasured depths of the southern ocean will be for the first time possible.

The new science of oceanography, or as Lieutenant Maury, its father, called it, "the geography of

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the sea," has been constantly in mind in the organisation and equipment of the *Belgica*. The outfit for fishing partly belongs to this department; unique devices for sounding the ocean in all depths by the Monacho machine (with pianoforte wire and steel rope as a line, sinkers which detach automatically, and a complicated system of special steam machinery) is now adjusted, ready for use. We expect to study the submarine currents, temperature, and the composition of the water. For all of this, we have special apparatus, perhaps not interesting to the average reader in a description, but the results are sure to add a new and startling chapter to the growing annals of ocean science.

The laboratory is in a small, specially constructed deckhouse behind the foremast. Its dimensions are small, perhaps fifteen feet long and twelve feet wide, but its capacity for storing instruments, and its convenience for work is phenomenal. It is intended as the centre for all scientific work, a sort of "union den" for the working staff, as the motto painted in large letters over the window "*L'Union Fait L'Force*," indicates. It will, however, be principally used for meteorologic, oceanographic, and zoölogical investigations. When one first steps into the laboratory, there creeps over one a fear to move, for everything seems a frail meshwork of glass; straight and spiral tubes, glass cylinders, thermometers, barometers, test tubes, bottles, and glass articles, too numerous to mention, are attached to all the available surface on the walls, the shelves and even the ceiling. At first appearance one would pro-

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nounce the frail fixtures short-lived, and it certainly seems as if a single sharp toss or sudden pitch of the ship would send the whole glassy splendour in fragments to the floor. The vessel, however, has rolled for three months on the destructive swell of the Atlantic, and, thanks to the carefully planned attachments, very few instruments have been broken; so we have reason to hope from this experience that the ice will not be more injurious.

A very complete library is on board. It is a library, like the men, of various tongues, and descriptive of a great variety of subjects. Each department has its technical bibliography. The Commandant and the writer have a general collection of all the antarctic narratives in all tongues. The Captain has a heap of charts and books on navigation; Lieutenant Danco has everything pertaining to terrestrial magnetism. The general scientific library is indeed a cosmopolitan collection. It contains books in French, English, German, Polish, Norwegian, and Rumanian print. In addition to serious literature, we have other books and magazines of lighter character. But these float about, from the laboratory to the cabin, and then to the fore-castle, always in the hands of those whose spirits need elevating. Weeklies with unusually good pictures, such as half tones of beautiful women, theatric or opera scenes are reserved and served after dinner as a kind of entertainment.

The quarters for officers and men are fairly good — palatial, as comfort is measured on a sealer. The Commandant has a neat little room behind the miz-

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zenmast, opposite to the kitchen. It is carpeted, nicely furnished, and the walls are artistically be-decked by old Dutch sketches, some paintings, and many photographs of polar scenes. We are so pressed for space, that we are told even this room will be partly filled with coal at Punta Arenas. The cabin is well aft; like the laboratory, the Comman-dant's room, and the kitchen, it is on deck. As we enter, to the right of the engines are the berths of the Captain and the mates, where they have the soot, steam, and smoke of the engine-room to im-press upon them the importance of their work, while the noise is such that prolonged sleep is impossible. The cabin is small, but full of comfort. It is as if eight men stood up around a small table, and a box were built around them, the corners and walls and ceiling being lined with books and instruments. It is not a very joyful place in the tropics, but when an endless sea of ice surrounds us, and the wind is blowing, and the decks are covered with snow, then, with steaming food on the table, we shall find its true value.

A door through the left of the cabin opens into an aisle, to the side of which are the four berths where the devotees of science sleep. The sides are thought-fully lined with lockers, but every nook, the beds, the ceiling, and at times even the floor, is covered with clothing, instruments and books. After a storm it is a sad rivalry in hopeless entangle-ment. The forecabin occupies the space between decks from the foremast to the stem. It is large, light, and, compared with the officers' quarters, ex-

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tremely comfortable. We speak French in the cabin, German and French in the laboratory, and a mixture of English, Norwegian, French, and German in the fore-castle. The life and order on board of the *Belgica* is that of a well-regulated family. Each man has his duties to perform, but he will also be expected to lend a brotherly hand to his companions as occasion may require. On clear evenings the music-box is often brought up on deck, and as the familiar tunes bound out into the strangely clear atmosphere, some sing, others dance; some walk about, and still others play games. The scene is truly melancholy upon reflection. We are going farther and farther away from home to the most desolate and forbidding part of the known or the unknown world. Our return is uncertain, our future is dark; but we have set out with this knowledge before us, and now it is our duty to aid in keeping up the general family cheerfulness. Whatever else may be our future success or failure, our domestic comforts are assured. When we assemble on deck after dinner, with the music to draw out a general feeling of well-being, a generous and unanimous air of joy rises with the ascending dew of the setting sun of the South Atlantic.

CHAPTER V

MONTEVIDEO TO PUNTA ARENAS

PUNTA ARENAS, Dec. 14, 1897.

THE *Belgica* raised her anchor and steamed out of the harbour of Montevideo Sunday, November 14, 1897. We were showered with the good wishes of the people, and loaded with the good things of the land. The entire Belgian colony followed us far out into the stream to bid us a final adieu, while the officers and men were kept closely occupied in answering the various signal salutations of the many neighbouring vessels as we passed. The deck strewn with provisions, hastily assembled at the last moment and alive with visitors, was a picture to send a thrill to the heart of a navigator about to encounter the worst sea on earth; but the happy disposition instilled by our congenial friends made us forget, for a time, all cares for the future. Soon we ploughed across the choppy waters of the River Plata under an uncomfortable series of squalls which seemed to come with a hiss and a force like bombs from a cannon. Before sunset we had left the low, blue line of hills which mark the northern banks of the river and the site of Montevideo, far

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under the northern horizon. We were again on our way to the snowy bottom of the globe, with intentions to stop by the wayside at the world's jumping-off-place, Punta Arenas.

On the following morning a heavy sea was pounding our port-bow, giving a quick lift, and permitting a sudden fall, to which our stomachs seriously objected. The sky was clothed with gloomy clouds having hard, zigzag edges like the margins of torn sheets of lead. We were, to all appearances, far out in the open expanse of the broad Atlantic, but, in reality, we were still in the mouth of the River Plata,—which accounted for the warm humid winds driving over our starboard. Much of the day was spent in an examination and rearrangement of our newly acquired equipage and provisions. It was to me a matter of agreeable surprise to find among these so many of the fruits and vegetables common to the New York market; but this is explained by the fact that Uruguay is a land of perpetual summer, where winter frosts are nearly unknown. The time of our visit was the spring of the southern hemisphere, November 15th, in the south, corresponding to May 15th, in the north; and while fruit and vegetable products are plentiful through the year, they are particularly delicious at this time. We had strawberries, cherries, apples, lettuce, radishes, peas, beans, artichokes, new potatoes, cabbage, and a long list of other fresh productions. There is, however, one great anomaly in the food supply of South America; it is the difficulty of obtaining fresh milk and the impossibility of securing good butter.

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This is particularly surprising in view of the fact that, in Uruguay and Argentina, cattle farming is at once one of the principal industries and a source of the principal wealth of the countries. That good butter and excellent milk could be made under competent management is unquestionable. At Buenos Aires several successful efforts have been made, and the best results have followed the efforts of a missionary who has taken to the management of cows in preference to the more difficult task of reforming Spanish American sins.

In the absence of butter one is, however, not so seriously disappointed after he is accustomed to the Spanish substitute, "*dulce de leche*," a sort of confection of milk. Mrs. Huysman, the wife of a prominent Belgian of Montevideo, had presented the expedition with a liberal supply of this, and after one or two introductions it proved quite a delicacy. *Dulce de leche* is a kind of sweet paste of the consistency of lard; at ordinary temperature it has a straw colour and no distinct odour. It is made of condensed milk, cane sugar and the marrow of the largest beef bones, the ingredients being worked together in a smooth homogeneous mixture, and then sealed in small tin cans. In this form it is much in use, and can be obtained throughout all of southern South America. The mixture is extremely nutritious, and aside from its position as a substitute for butter it has evidently special values of its own. I see no reason why it could not be introduced with advantage into the United States.

On the morning of the 16th, the sky was clear of

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the heavy clouds which descend with the stream of the Rio de la Plata. There was a little air, dry and pleasant, coming from the Patagonian pampas over our western horizon. The sea was a joy to behold. Its surface was like a sheet of silver, glassy and luminous, with long, easy and regular undulations. Through these the *Belgica* steamed with a grace and ease quite befitting a pleasure yacht. Under the inspiration of the morning, we were prepared to deny the evil reports so often made of these waters. That such an easy sea, and such a heavenly sky could in a short time be transformed into a howling mockery by the storm demons, did not seem, to our innocent trust in nature, a possibility; but the afternoon brought with it signs of uneasiness. The steady air from the west ceased, and little breezes followed from all parts of the compass. The exquisite bright blueness of the sky changed to a smoky blue; but at two o'clock there were no clouds and nothing on the horizon to indicate danger. The atmosphere became quickly humid and heavy, making respiration seem difficult, while the barometer was spasmodically rising and falling. That there was some unusual phenomenon which we were about to witness, we felt convinced, but we were long in getting hints as to its nature.

At about four o'clock a sharp dark line, like a perfectly straight bar of iron, was seen over the southern horizon. It rose with wondrous rapidity and as it ascended above this central bar there swelled out a perfectly smooth and even roll of weirdly luminous vapour. Across the rounded surface were

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small, ragged films of intense white and steel gray passing with lightning haste, and this gave the upper line an awe-inspiring appearance. Under the central bar the cloud was of a dark steel gray, but we could at no time see the sky, or even the horizon under the advancing commotion. We were intensely interested in the sight, but it did not seem to us particularly dangerous, nor did it strike the sailors with the terror which I have seen less imposing sky-effects produce. The strangeness of the sight, however, put the officers on guard, and every surface of sail that could be taken in was at once furled. The sea now began to rise and it was strange to watch it. It first boiled, apparently without wind, into short waves. This the following wind straightened out like the wrinkles of a cloth under a smoothing-iron. Then other waves rose too high and too solid for the wind to flatten. These increased in size, and multiplied in numbers, and rushed towards us in huge coils of spray. The *Belgica* pitched and tumbled in the resulting sea, but as yet no wind had struck her. The water and the air was lighted with a sort of vague pearly glow. At this time the strange line seemed just over our bowsprit, and extended entirely across the heavens from east to west, but only a little draught of air crossed the bridge.

I turned to watch the men who had suddenly left their work and were coming down from the rigging. All at once the bark was struck with terrific force, and stopped as suddenly as if she had struck a stone wall; this was followed by a howling, maddening noise as the wind passed through the ropes and

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spars such as I had never heard before or since. Everybody grasped a bar or a rope to keep from being swept overboard. The bark, after the first thud, raised her bow and drove her stern into the boiling sea, and then righted, seemingly prepared for the next assault. After a few other, but lesser, puffs, the wind came with a steady hiss — like steam from an exhaust pipe, and its force was expended with the same rapidity with which it fell upon us. From the commencement to the termination this strange onslaught occupied but fifteen minutes; but this was as much as I care to see of a hurricane of this sort, though they are sufficiently prevalent in this region to receive the special local name of *pamperos*. A *pampero* is apt to leave a lasting impression on one's mind, and on the *Belgica* we date all of our events from the time of its occurrence.

For a few days following the *pampero* we were gliding along the coast of Patagonia, but out of sight of land, under the most beautiful skies and in the most delightful weather imaginable. Pleasant weather, however, makes the life of a sailor monotonous and far from enjoyable, because it affords time and opportunity to mend and dress and polish the ship. Such was the work of the crew here. The tropical sun had brought out some of the oil and not a little of the fishy odour with which years of blubber hunting had filled her. The paint, also, which had been piled on in different colours, year after year, came off in large sheets like the bark of a dead tree. To mend and dress the *Belgica*, then, in a suitable garb for the perpetual frost of the south pole was a matter of considerable work.

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The skin of the bark was scraped, and painted, and varnished, and polished, new sails were fitted, old ones repaired, and all of the sailing gear was strengthened for the expected blasts south of Cape Horn. Waterproof covers were made for the various bits of machinery and the instruments openly exposed on deck. Between decks the provisions were being examined and restored. Supplies and equipments were put aside for a wintering party in the antarctic. The cabins and the forecastles were to be cleared and altered for more prolonged habitation, and the hammocks were put away, not to be used again for a long time. Henceforth we must take to our berths, which are like hermetically sealed cans. These bunks have been made to fit each man, in length and breadth, according to careful measurement. The result is that the fit is like that of a snug boot, but the comparison is hardly admissible, since a neat-fitting boot flatters vanity, and pleases the eye; but where are the joys of a boot for a bed? I must hasten to add that such an economy of room was necessary; but, unfortunately, either the beds had shortened, or the men had lengthened, for two men presently complained that their bunks were now six inches too short.

The pleasant dispositions and the regular daily occupations, which come with continued fair weather, were abruptly set aside on November 26th. Our eyes in the morning opened under a sky dark, gray, and gloomy. This was soon enlivened by wildly moving cloudy streamers, under which the sea tumbled in huge cliffs, and our stomachs raised in long reaches. *Mal de mer* was the openly acknowledged

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pastime of the hour, and it seemed to be in evidence in direct proportion to the mental development of the personnel. The Captain, for example, was the first victim, and he was followed by the most capable sympathisers of the *état major*. These were followed by the ordinary seamen, the man of lowest mental development being usually the last to loosen the gastric bonds. Let this be a comfort to victims of Neptune.

The wind poured upon us in hard, steady blasts from the south-west for nearly two days, which gave us, on our growing menu, a taste of the normal weather of the "roaring forties"—a relish which a heavy lumbering sealing craft is apt to impress upon the memory. We were hungry for the sight of land, which the Captain had been promising us as an appetiser from hour to hour; for we had been a fortnight without seeing anything but the blackness and blueness of the Patagonian sea, and anything in the form of land would have been a feast to our eyes.

Early in the morning of November 29th a low straight line, like a huge beam of wood, appeared to separate the grayness of the sky from the soft blue waters in the south-west. It proved to be the northern cape of the eastern entrance of the Strait of Magellan,—Cape Virgins. The name is fascinating when one feels he is at the world's end, and land in any form in this locality is an encouragement, but there is nothing about the topography of Cape Virgins which would arouse much admiration. It is a long, sandy cliff one hundred and thirty-five feet high, its base descending perpendicularly into the

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sea with the interruption of an occasional shingle point, where it appears as if a boat might make a landing. Its colour varies much with the position of the sun, the character of the atmosphere, and the cloudiness of the sky. As we approached, it at first appeared nearly white, with occasional dark shadows when the surface was uneven, and the entire wall was crested by a thin but smooth line of green grass. At this time the direct beams fell upon the coast from the sun, still low on the eastern skies. A few hours later, when we were nearer and the sun was under a light cloud, the cliff appeared like a wall of terra cotta. The cape is the seaward termination of a long range of low hills extending across Patagonia.

Cape Virgins is one of the most important landmarks on the Atlantic seaboard, and its discovery marked the beginning of the most important period of maritime adventures in the history of navigation. Before we pass it, and enter the now famous Strait, permit me to give a few incidents in the story of the discovery of this cape and the hard-earned but triumphant entrance into the narrow path which permitted the first circumnavigation. The credit belongs to a Portuguese, Fernão de Magalhães, and the honour belongs to Spain, for the expedition was under the patronage of the Spanish crown.

Magalhães assembled his fleet at San Julian on the Patagonian coast, Easter Eve, in the year 1520. Here he spent the few months of southern winter, from April to October. During this time he first saw, and his historians first described, the pampa

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Indians whom, because of their loosely booted feet, they gave the ill-fitting name of Pata-gones : a name which all the world of women should detest, for it means clumsy-hoofed. From this first designation given to the people the entire country from the Plata to the Strait, has been given the name of Patagonia. Patagonia, then, fully translated, means the land of the clumsy-hoofed people. This is unkind when, in reality, the Indians of this region have feet which are not only smaller, but far neater in shape than those of Europeans of the same size and weight. At this anchorage Magalhães had some trouble with his officers who committed the unpardonable crime of differing from him in their opinions. To one of these men a letter was sent with a messenger who had instructions to stab him while reading. Other officers were executed with similar despatch. Magalhães was evidently a good representative of the saints of his day, upholding the church with one hand, and committing the blackest deeds of Satan with the other.

On October 21st, Magalhães entered the Strait for which he had searched and, though he had killed some of his officers but a short time previous in a manner which would now be considered premeditated murder, he honoured the saints by calling the channel Canal de Todos los Santos—Canal of all the Saints. The cape on his starboard, as he entered, was named the Cape of the Eleven Thousand Virgins, in honour of the day on which it was discovered, St. Ursula's day. Succeeding generations have thought less of the saints and more of Magalhães,



A. O'penti.
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Fuegian Boys

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and have named the canal in honour of its discoverer, but even the discoverer's name has changed with time, for to-day we write Strait of Magellan, and not Magalhães. The cape has also suffered a change by the later and less religious geographers. Eleven Thousand Virgins, even as a name, is too flowery for a Cape Horn sand-bank, and furthermore it was the hunting ground of a people among whom the term virgin would be useless. Just at present this point of land is charted Cape Virgins, and its virgin soil is being broken by thrifty gold diggers.

Returning to our present voyage and to the less sentimental, and less brutal, but I fear less religious modern times, the *Belgica* has not only no one to fill the chaplain's duties, but, so far as I know, only one Bible (which is kept under cover) and no prayer book. Religion is apparently not one of our missions. But then I must hasten to add that on expeditions of this kind land pilots are more necessary than "sky pilots."

At noon we rounded the low sandy bar extending southward from Cape Virgins terminating in Dungeness Point, and entered the historic Strait of Magellan. The eastern beach was strewn with fragments of iron from the hull of the iron vessel *Cleopatra*, which was one of the many vessels wrecked here. The skeleton of the *Cleopatra* was still fighting the sea some distance off shore, and presented a picture which would run into delight under the brush of an artist. The western shore of the point was strewn with fragments of wooden vessels, and two hulls well ashore rocked like cradles, but were ap-

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parently not much injured. This point seems to be a convenient graveyard for marine crafts.

To our south under a dark bank of cumulus clouds was the white cliff of Cape Espirito Santo, which, like Cape Virgins, is the termination of a long range of hills on Tierra del Fuego. The waters were alive with innumerable forms of life, many of which were new to us. Whales, seals, porpoises and penguins were darting about in the sea like birds in the air, while resting on the glassy surface, hovering over the land, rushing over and around the *Belgica* were strange members of the feathered tribe; among these, albatrosses, gulls, petrels, ducks, and geese were most numerous. The profusion of animal life around us, the blackness of the lowlands to each side, and the encouraging prospect of the channel before us, furnished a sort of wild fascination which is probably as great in our day as in the time of the early pioneers.

Passing westward we had, by midnight, reached the entrance of the first narrows. Here we anchored for the night. For three long months we had gone steadily and persistently southward in one general direction; such a monotony of course draws the Atlantic out into an unimaginable length, but now we were headed westward, away from the Atlantic with its fickle winds to the more friendly Pacific; and our course in the future will be more varied — a circumstance which seems to arouse an agreeable train of thoughts. These thoughts, with the peculiar and continual interest of the scenes around the ship, kept us awake for a large part of our first night in the Strait.

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From time to time I left my bunk and paced the poop that I might better see the wide panorama under the varying shades of the night. There were marvellous changes in colour and in the general aspect of the land, with imperceptible changes of light. This I had noticed earlier in the day and it continued throughout the night; but of this I can hope to give only a crude outline, for the delicate shades of colour and the infinitesimal grades of light cannot be spread out with black and white under a quill. As the sun sank behind the hazy outline of the Cordilleras Mountains, over the Patagonian pampas, the grassy surface everywhere assumed a bright yellow tint, in harmony with the gold which is now scraped from the ground. The sandy cliffs which walled the shores were inky black on the north, and bright gray or brown on the south. The water retained its dark green hue until the semi-luminous, semi-liquid, purple of the long twilight flooded the whole scene. Then followed the short blackness of the night which again blended into an exquisite purple morning. As the sun rose over the cliff of Cape Virgins, the vast treeless plains were marked into sharp figures of brown and yellow and red. Hence these regions, like tastefully dressed women, have a special dress for every part of the day, and this garb changes the appearance of landmarks in such a manner that at times they are difficult of recognition. I will not force the parallel — but thus in one of the elements of beauty in this Strait, lies one of its greatest dangers to navigation.

We tipped our anchor in the morning and advanced to the mouth of the second narrows, where

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we anchored at 4 P.M., December 1st. Here we learned from the latest budget of the French coast-pilot that there was a French settlement, and from the *Belgica* a number of farm-houses were visible, which seemed to confirm the information. We accordingly prepared to pay the occupants a visit, and also to search the surrounding territory for specimens. Landing in the bend of Gregory Bay with a corps of scientific collectors, hunters and sailors, all of an adventurous turn of mind, we soon spread over the grassy pampas in every direction. Three of us who went to visit the farm-houses soon discovered that the coast-pilot's information was not up to date. The Frenchmen in question had disappeared about ten years previous, and the entire region, practically everything within sight, belongs to a very wealthy Chilean sheep farmer, by the name of Menendez.

At the first farm-house we found a couple of Scotch shepherds who informed us that the main station of the farm was a few miles east, and to reach this they offered us horses. The Captain and I accepted and were soon mounted, but before we returned we had some regrets. The animals objected to their burdens from first to last, and I might add that we objected to their manners at once and for all times. Like all Patagonian horses, they are trained to take their direction by the throw of the reins, and not by the traction of the bit. If the rein is thrown against the left side of the neck, the horse goes to the right, and *vice versa*. It is hard to adopt the method at once without a certain amount of traction on the bit to which one is accustomed;

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but this lateral traction the pampa horses will not permit. If you will hold a tight rein you must hold it with equal tension on both sides, and hold it steadily, or the animal will stop at once, and perhaps with such suddenness as to make you test the hardness of the ground. The horse also has a motion and a gait which is absolutely peculiar to the pampas. These peculiarities soon drive chagrin to the heart of a northern horseman.

We galloped eastward in a beaten path close to the placid waters of Magellan Strait. To our left were a low series of hills—the Gregory Range—and behind these the sun had fallen, throwing its parting rays on the shore-line of Tierra del Fuego opposite, and over the distant Fuegian mountains. The novelty of the ride and the fascination of the scenery helped us to forget the bruises and accumulating pain—of which, however, we were forcibly reminded later. In an hour we reached our destination and had an opportunity to see, for the first time, one of the end-of-the-century wonders,—the re-discovery of Patagonia and Tierra del Fuego by the sheep farmers. Here were the men by whom, and the method by which, the hopeless sterility of the end of the continent has been turned into a field of industry with a farming profit perhaps equalled in no other part of the world.

A young man with a sporting air advanced from one of the buildings to meet us. He was Alexander Menendez, the chief of the place, and the son of the Cape Horn Vanderbilt. Spanish is the official language of this region, but neither the Captain nor I

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spoke it, and thus we were a little anxious to know the tongue in which we might interchange ideas. We could handle between us French, Flemish, English, German, and Eskimo, and we rather flattered ourselves that the man who could not converse with us in one of these tongues could have few ideas worthy of exchange. We had no need for anxiety, however, for our new host spoke English and German and some French, in addition to his national tongue. Indeed, English seems to be the general language of the sheep farmer. Mr. Menendez took us to his little home, a one-story wooden building, with three or four rooms. Our mission was hardly more than a formal visit, but pampa customs are such that one immediately enters into the inner life of the ranchmen from which it is difficult to separate quickly.

Here we found a sheep ranch in its youth, but its proportions were already such as to startle most North American farmers. Upon a treeless waste of 90,000 acres, spread out in easy undulations along the Magellanic waters, were 120,000 sheep. The climate and the grass are such that the animals require no shelter and no extra feeding, not even during the coldest winter months, and they are so nearly self-supporting that one shepherd manages a herd of 2,000 animals. When sheep thus thrive and multiply at next to no expense, and on ground which was first obtained for the asking and taxes, it is not difficult to understand the success of Patagonian farmers.

The same enterprising Menendez has several other



Indian Mission Huts.



Part of Punta Arenas.

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farms, the most promising of which is across the Strait, and to this our eyes were directed with considerable pride by our host. This farm occupies the lowlands of north-eastern Tierra del Fuego, which is said to be the best sheep land of the entire region. Here, upon about 120,000 acres, there are 150,000 sheep turning wool into gold faster than any gold mines could be expected to offer yellow metal.

Mr. Menendez, however, like all managers of great enterprises, had his troubles: "Sheep farming is very profitable," said he, "but we have one great difficulty—it is to secure good help." This ought to be a cheerful notice to the unemployed thousands of Europe and America, but it should be accepted with a proper appreciation of the life and work in question. A Patagonian shepherd lives the life of a wild man. In the saddle he roams about on the pampas with his sheep, and at night he makes camp like an Indian. But there are many men who enjoy just such a life, and for such there is plenty of room in this region. The usual pay is about thirty dollars (gold) per month, but expenses are next to nothing, and an additional income is added to the regular pay by the products of hunting, such as ostrich feathers, guanaco skins, etc. The men at present employed are mostly Scotch shepherds, but some of the best ranchmen have been made from ordinary seamen. In the newer methods of shearing and other improved mechanical contrivances, machinists and other artisans are in demand. Many of the men who have come here as workmen are now ranch-owners themselves, and few who have once tasted the elixir of pampa life ever

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leave it again for the noise and the strife and the gilded glitter of the upper world.

When we again mounted our horses to return, we were somewhat disposed to lay aside polar exploration and become sheep farmers, but this idea was soon dissipated by our efforts to return to the *Belgica*. The purple twilight was just deepening into the darker shades of night as we left the little group of buildings which constitute the headquarters of the Menendez ranch. The horses seemed more than ever opposed to their inexperienced riders, and our discomfort was such that we did not hurry them. We preferred to leave to them the selection of the path, and the rate of progress, while we drank in the sharp antarctic air and enjoyed the glory of the night scene. It was nearly midnight when we reached our canoe. Here we found our companions impatiently waiting for us, some seated on boulders, others stretched out on the grass, and a few chatting with the shepherds in the nearest hut. But we were somewhat dejected as we gazed upon the sight before us; the water had run out with the tide to such an extent as to leave our boat high and dry some three or four hundred feet from the nearest launching-place. Every foot of this distance had on it a covering of a soft semi-liquid mixture of clay, sand, small stones, and shell-fish. The *Belgica* must start with the tide at day-break, and her whistles were already tooting the signal to hasten on board. To wait for the tide was impossible, so we started our canoe over the debris. If the surface had been tar it could not have offered more resistance, nor could it have caused more dis-

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comfort. After an hour of almost superhuman effort we reached the water, but we were covered with slime and mud and perspiration from head to foot, and we agreed that our first Patagonian debarkment was a decidedly expensive luxury.

We reached the *Belgica* as the eastern skies brightened with the coming morning twilight. The anchor was raised immediately, and while our aching muscles were resting, we were transported through the second narrows to Elizabeth Island. In three hours we were opposite the island and accordingly prepared for another debarkment. Our object in stopping here was principally to obtain a supply of the wild geese for which this island is noted. We landed in a cave near a lonely shepherd's hut, and scattered over the island, being careful to leave two men to keep the canoe afloat that we might not renew our experience of the previous night.

We found the geese extremely numerous, but either they were too well acquainted with firearms, or our workmen had been too long seasick, for, from the result of our hunt, we were able to produce only a dozen birds. Elizabeth Island, like all of the grassy ground of this region, is devoted to the interests of sheepfarming. It is upon this notable island that the first Magellanic sheep-farming experiment was made. Mr. H. I. Reynard, an Englishman living in Punta Arenas, first conceived the idea early in the seventies. Perceiving that sheep and cattle thrived in the Falkland Islands, whose climate and vegetation was in most respects similar enough to

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that of Elizabeth Island to warrant the expenditure necessary for a proper trial, he accordingly established here the first sheep colony. The sheep took so kindly to their new home, and multiplied so rapidly that, though the island is eight miles long and two miles wide, it was very quickly so thickly stocked that numbers of the sheep were transferred to the mainland. From this experiment in farming Mr. Reynard was reported, in 1894, to be enjoying the princely income of a hundred thousand dollars annually.

Among our collections from this island were a number of flint arrows and spear points, which seem to be abundant in the numerous heaps of mussel shells and other sites of old Indian encampments. But the island has long been deserted by the Indians, for, even at the time of its discovery by Drake, three hundred years ago, none are mentioned. The discovery and naming of this island is thus described by the old records: "The 24th of August (1578) being Bartholomew's day, we fell in with three islands bearing trianglewise one from another; one of them was very fair and large and of a fruitful soil, upon which, being next unto us, and the weather very calm, our General with his gentlemen and certain of his mariners then landed, taking possession thereof in her Majesty's name, and to her use, and calling the same Elizabeth Island." The other islands are those now known as Santa Marta, and Santa Magdalena Islands, upon which Drake found penguins so numerous, that, in one day, not less



The Wind-swept Rocks of the Western Fuegian Islands.

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than three thousand were taken and subsequently used as food.

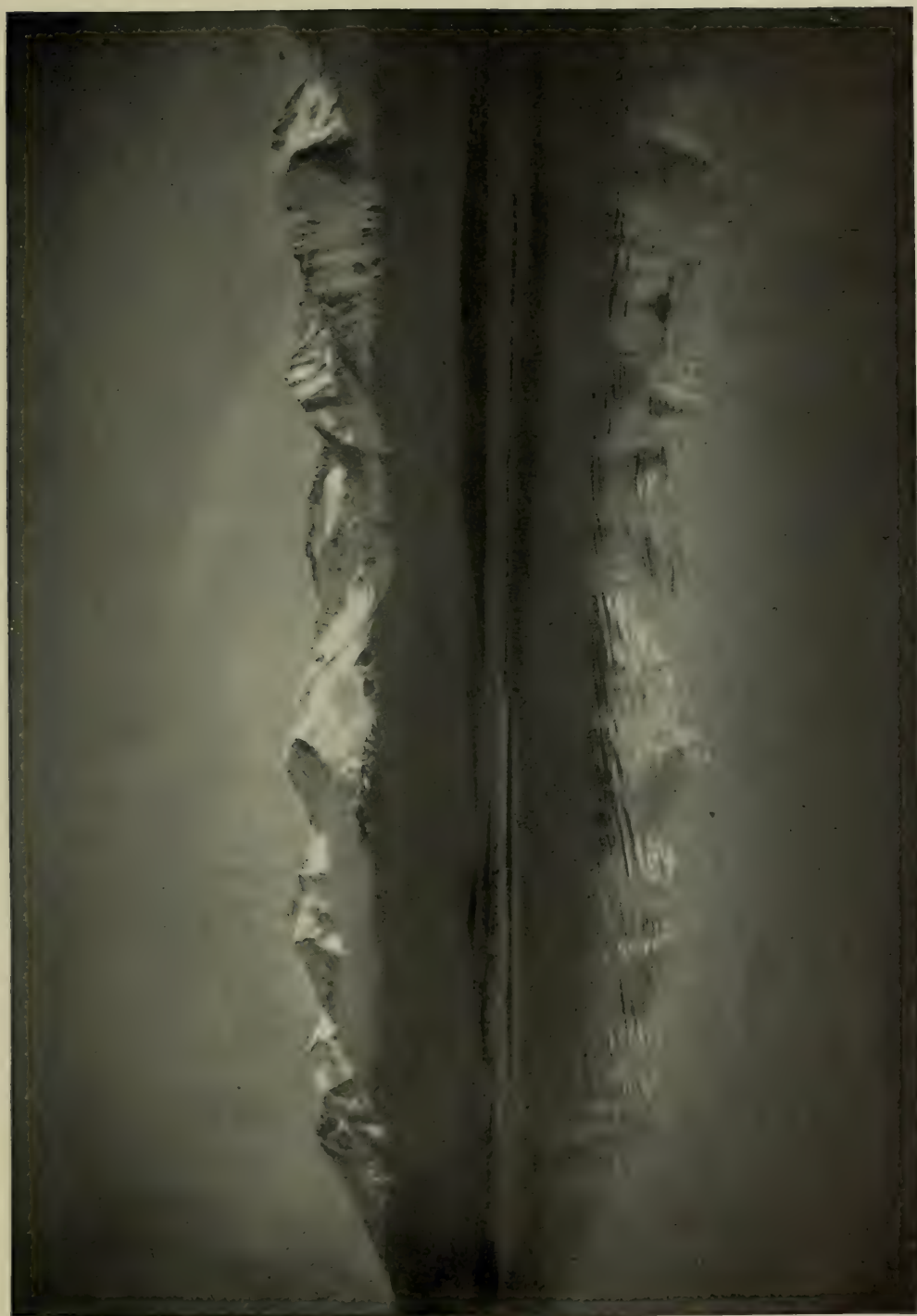
We left Elizabeth Island at 10 o'clock in a mist of cold, drizzly rain and steered westward close to its low sandy cliffs. The mist occasionally raised and gave us a glimpse of the land. There is a ridge of small hills running parallel to its length through the centre, the highest of these being one hundred and eighty feet above the sea. The hills were made more conspicuous by various clusters of a bluish shrub, but aside from these there were no trees and nothing but the hardy pampa grass to cover the sandy soil; nevertheless, with its shepherds' huts, and its vast herds of sheep, Elizabeth Island is not without an air of attractiveness.

At noon the atmosphere had cleared and the ever-present dark, feathery clusters of vapour shaded the water and gave it a despairing blackness. Over our port bow a low buff-colored point extended far out into the widening strait. This was our first sight of the famous Sandy Point, whose notoriety is sure to reach the ears of every South American voyager. Here also we noticed a striking change in the topography of the land and in the character of the vegetation. We had left the smooth, treeless pampas behind us, and before us appeared a wild rugged country, the lowlands covered by a dense forest, and the highlands white with snow. These were the the foot-hills of the terminating Andes, a place well calculated to shelter the Cape Horn capital from the never-ceasing stormy blasts.

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Early in the afternoon we rounded the point and at four o'clock we anchored in Sandy Point Road. The harbour presented an air of thrift quite out of proportion to the barrenness, sterility and gloomy wildness of the region. Five large ocean liners were at anchor, and many small coasting steamers, with a host of lighters and small crafts, were scattered about on the unruly waters; but the town from its distant appearance was a disappointment. One hears so much about this settlement, its rapid growth, and marvellous development, that one naturally expects to see a substantial city. "Thirty years ago," said a native, "we were less than two hundred settlers here; to-day we number six thousand, and you have before you a good-sized city. Don't you think our growth has been remarkable and quick?" One must naturally answer in the affirmative, and to the average European the phenomenon is wonderful; but to an American it is wonderful in quite another direction. The town is in most respects a miniature reproduction of the mushroom town of the western states: a wilderness of low wooden and sheet-iron huts which are quickly and cheaply constructed and as quickly destroyed. Punta Arenas has been building for thirty years. Towns of the western United States of a similar nature spring up in as many days. A Yankee, then, wonders not at the reported rapid growth, but asks, "Why has it taken so long?"

After we became accustomed to this appearance of cheapness and instability which characterised the place, we found much of interest and some things



Terminating Ridge of the Cordilleras, Beagle Channel.

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absolutely astonishing. Punta Arenas has a character and a life which mark it at once as one of the most peculiar towns on the globe. We were boarded long before we came to anchor by agents of provision houses, boarding-houses, hotels, saloons, and health officers; but strangely enough no custom officers paid us even a friendly visit. Our business arrangements and not a few social arrangements had been made by Mr. Racovitza, who had preceded us, and shortly after we came to anchor we made our headquarters in the little French Hotel where a welcome bag of correspondence awaited our arrival.

CHAPTER VI

PUNTA ARENAS, THE SOUTHERNMOST TOWN

USHUAIA, Dec. 22, 1897.

WE decided, before we left, that Punta Arenas, as a town, is very extraordinary in many ways when you come to know it. Aside from the fact that it is the world's southernmost city, the metropolis of the lower end of the American continent, the dumping ground for so much of discontented humanity, the capital of Chilean Tierra del Fuego and Patagonia, and a host of other large sounding, but small meaning, names,—it is one of the most cosmopolitan towns of the universe. Its life and its business are absolutely astonishing.

There is a sort of effervescent interest which one quickly acquires in this little speck of bright life and its gloomy wilderness. The interest begins with its misty history and ends, perhaps, to-day with the modern re-discovery of Patagonia and Tierra del Fuego by sheep-farmers and gold-seekers. After Magellan discovered the Strait, and led the way across the jewelled waters of the Pacific, the enterprising Spaniards, with the important permission of the Pope, gathered easily and peacefully the

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accumulated wealth of the fertile islands and opulent empires of the South Sea. Any competition from other nations was forbidden by the Pope and prevented by the supposed danger of passing through the Strait. Both of these dangers were braved by the bold half-pirate, half-explorer, but entire seaman, Francis Drake.

Drake entered the Pacific through the Strait in 1578, and, with a scurvy-pestered crew, deprived the Spaniards of their gold and silver somewhat more easily than they had taken it from the Indians. To prevent this re-harvesting of their easy-gotten profits, Pedro Sarmiento de Gamboa was despatched from Lima, in 1579, to survey the only supposed entrance into the Pacific, the Magellan Strait. Sarmiento advised a fortification of the straits, and, accordingly, two colonies were placed on commanding points. These were the cities Nombre de Jesus, near the first narrows, and San Felipe, at what is now called Port Famine. But eight months' provisions were left these poor protectors of Spanish gold, and they perished miserably before relief was sent them. Only two survived to tell the tragedy, and these were rescued by the British seamen—the men whom the Spaniards were sent to destroy. Sarmiento, who placed the colonies, was captured by one of Sir Walter Raleigh's cruisers on his return voyage to Spain.

As this first chapter in the history of the Magellan Strait closed, its importance also vanished, with the discovery of the passage around Cape Horn by the Dutch navigators, Schouten and Le Maire; and for

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two hundred and fifty years following the region was left to the possession of the arctic life with which nature had stocked it.

In 1843, with no knowledge of the real worth of the Magellanic regions, but with a sort of natural pride to possess the historic strait, Chile placed a colony at, or near, the ancient site of San Felipe. This was a penal settlement where political prisoners were sent. It was a sort of Chilean Siberia, just as Staten Island is to-day for Argentina, and thus the venture filled two missions: it held for Chile the Strait of Magellan, and placed the troublesome convicts far from the capital, Valparaiso. This was a particularly appropriate spot for that large class of Spanish-American citizens, the ever restless revolutionists.

But men whose occupation is revolt, whose life is a constant navigation of dangerous rapids, are not the proper sort of citizens to build a town. This was soon learned in "La Colonia de Magellanes," by which name this antarctic exile colony was officially known. Anything which savoured of work was opposed to their natures. War, riot, massacre, brutal freedom, were more to their liking, and this revolting spirit was not a little fired by frequent famines, when the infrequent vessels from Valparaiso did not arrive. The place thus acquired, by hard experience, the name of Port Famine. One day the exiles rose to arms, killed the Governor, and took the town. For this they were all strung up by the necks from the yard arms of a Chilean gunboat.

The buildings of Port Famine having been fired,

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the Government, after deciding on a re-establishment of the colony, selected for the site of its town a long tongue of sandy ground a few miles farther north. This is the site of the present famous town, Punta Arenas, and it takes its name from the sandy point on which it rests. Punta Arenas, or Sandy Point, like the first colony, had as its principal reason for existence a penal settlement, and its population was composed of men of the same class — mental and moral outcasts, revolutionists and high-handed criminals. The new town met a fate similar to that of the first settlement. The prisoners revolted and, assisted by the soldiers who were sent to protect the town, they sought the Governor. But to keep his own blood from being spilled, this unworthy official deserted his wife and children, and left for parts unknown. They caught the commander of the garrison, and massacred him in a shocking manner, after which they took the town and held a sort of drunken festivity for three days. The Governor, in his retreat, had found a Chilean cruiser, and as this came in sight of the town the rioters, to save their necks, took to the pampas. Here most of the miscreants came to a miserable death by starvation, fatigue, and cold. A few reached the Chubut River and were taken to Buenos Aires, where the liberty for which they had struggled was given them.

This last destruction of the colony occurred in 1877. At this time Punta Arenas had already risen to some importance. It numbered, among its exile settlers, several independent citizens; and these

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were the creators of the true Magellanic metropolis. No more prisoners were sent. The town was left to live and flourish, according to its resources, or to die a natural death. Fortunately, its resources had already been discovered. Some of the desert-like pampas, upon which the liberators famished, had been stocked with sheep, and they thrived unexpectedly. Gold had been found in the creeks, coal had been found but a short distance off, the forest appeared inexhaustible, and steamers were beginning to cut the solitude of the Strait. Dissatisfied, rejected and venturous sailors cast in their lots with the builders of the town. Shepherds, gold-diggers, traders, adventurous wanderers, and stripplings from the world's population — a heterogeneous mixture — came to rest here as a last resort. The semi-Yankee life of Punta Arenas takes its origin from this mass, and the town owes its growth, very largely, to the fact that its site is a terminal morain to a restless stream of human life.

With this preliminary understanding of the causes for the metropolitan life of the Strait of Magellan, one is not so greatly surprised at the first glimpse of the strange street scenes. We naturally looked for some marks of nationality in the people we first met, but quite in vain. Spanish is the language of the place. At one street corner, however, one hears English; at another, German; at another, French; and at still another, Italian. Negroes are few, but Indians are quite numerous. One of our new acquaintances took us about town. He was, I believe, a German by birth, but he talked with us in French,

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and took us to a bar where he talked English ; to a magazine where he addressed the clerk in Spanish ; to the church where he addressed the Holy Father in Italian ; and others told us that he could speak the various Indian tongues, and was not puzzled with Latin and Greek, though he never had had a college education.

The streets are ordinary country roads, in very bad order. They are most remarkable for their number of stagnant pools of water, and the various heaps of ashes and debris. Stumps of trees, broken carts, tin cans, packing boxes, dead dogs, and a host of other refuse serve to ornament and pave the sandy bottoms. Scattered about these, and usually not far from a bar, are groups of visitors in various attitudes. The most numerous of these are the cowboys or gauchos, as they are called some on horses with ponchos over their shoulders, and wearing huge, broad-brimmed hats, and loose pantaloons ; others steeped in alcohol with a soft bed of sand for a couch, and a boulder for a pillow ; and still others, in new suits, moving about like a girl in an Easter bonnet to display their annual acquirements. But the gauchos move in groups to themselves, discussing sheep and squaws and the hunting sports of the pampas. In another group one finds quite different types of humanity. Here are the gold-diggers, men of extremes, either without a copper or with a fat bag of gold, according to the luck of their past season. Unlike the cowboy, who is usually in neat attire, the miner is careless of dress, and, rich or poor, is rigged in rags ; but he is a bit of a lion

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in his way. If he has found rich deposits, his pocket is the ambition of the local tradesmen, and his information is eagerly sought by all the loafers of the town. He discusses pay-diggings, nuggets, methods of washing gold, the relative qualities of food and drinks, and his last feminine acquaintances in Sandy Point. And then there are the groups of sailors, soldiers, and of tramps. The citizens of the town one rarely sees; they are always occupied within doors, for everybody who is anybody in Punta Arenas keeps a store and owns one or more sheep-farms.

The location of Punta Arenas is rather unique in its natural surroundings, and in its commercial advantages. To the west and north-west are the slowly rising forest-covered highlands, terminating in the high, ice-covered peaks of the Cordilleras. To the north-east and east are the endless undulating plains of Patagonia. To the south and south-east is the Strait of Magellan and beyond are the blue hills of the northern plains on the main island of Tierra del Fuego. To the south-west are the bleak islands belonging to the Fuegian group. This location has helped to make the town the trade centre of the great regions south of the Rio de la Plata.

The two very important discoveries already alluded to have made life and a prosperous population just possible in this vast savage land. Only a few years ago all of South America south of the river Plata was believed to be a useless waste of barren ground, peopled by man-eating savages. Even to-day this is generally believed to be the state of



Ona Women, in Full Dress, with Papoose
Strapped to the Shoulders.



Ona Men on the Chase.

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affairs in Patagonia. But it is not true. The pioneers here are in better health and are accumulating gold more rapidly than in any other part of South America. The reasons for this great transformation are the discoveries that sheep will thrive and that gold is strewn on the various sandy beaches. The possibilities, thus afforded, have brought the people and the capital to America's southern end, and have made Punta Arenas the centre of a population of pioneers, mostly rich in profitable land and in sheep, but poor in worldly comforts.

When the far-seeing Englishman, already referred to, brought the first sheep from the Falkland Islands about twenty-five years ago, they thrived so well in their new home, that soon many others did likewise. To-day almost every acre of available ground is stocked with sheep. This sheep-farming, however, is done on such an immense scale that even a Yankee farmer will be compelled to feel his littleness. Space will not permit me to dwell on this interesting subject, but a man owning ten thousand sheep is considered to be a small and poor farmer; one owning fifty thousand is quite ordinary; and men who have a hundred thousand are not uncommon. The Cape Horn millionaire is not noted by the number of dollars he possesses, but by the number of sheep he shears.

Gold mining is the occupation of the poor, and the idle population. This is not because gold is scarce or the occupation unprofitable, but because it requires little capital, and yields immediate returns. With a shovel and a pan, inexperienced men earn

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five dollars daily. The gold is widely diffused, but is seldom in very rich placers. Many of the creeks and the beaches of Patagonia, both on the Atlantic side and in the Strait of Magellan, are known to contain gold. The same is true of Tierra del Fuego. Even the mud of the streets of Punta Arenas is said to contain the yellow metal.

The architecture of Punta Arenas is similar to that of the mushroom towns of the western plains. The houses are made of corrugated sheet-iron, and are altogether uninteresting, except in that they are constructed of material brought six thousand miles, while within a thousand yards is a virgin forest of excellent wood. During the short time of one year, electric lights, telephone, and telegraph plants have been established, a really good theatre has been built and several churches are in the course of construction. Nearly every house sells intoxicating drinks. Alcohol is said to be served even in the churches. Indeed, alcohol is at the base of all the crimes and most of the pleasures of Punta Arenas.

Unlike the immigrants to the United States, the new-comers to Patagonia have remained as separate little colonies, and never made a homogeneous mixture as in our States. They await with yearly anticipation an opportunity of returning to their mother countries. The sheep-farmers and bankers are mostly British, the storekeepers generally German. The Anglo-Saxon is the ruling spirit, and in a very short time this long deserted no-man's-land will be a gilded paradise stocked with the healthy mixture of northern races which has made



Chief Colchicoli.



One of Colchicoli's Wives.

Types of Onas.

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the United States the most progressive of the new nations of the world. Southern South America is to be the Yankee land of the far south and for this, their absorption as stupidly suggested by Rhodes is entirely unnecessary. The people here are able to take care of themselves, and the Republican governments of Chile and Argentina are quite capable of managing their own affairs.

CHAPTER VII

FROM PUNTA ARENAS TO USHUAIA, THROUGH THE FUEGIAN CHANNELS

USHUAIA, Dec. 28, 1897

AFTER spending a fortnight at Punta Arenas, restocking and refitting the ship, studying the surrounding regions, and accepting the warm hospitality of the citizens, we tipped our anchor at midnight of December 14th. We then set a course almost due south for Famine Reach. The little gunboat *Torro*, detailed by the Chilean officials, escorted us for several hours. The early part of the night was clear, which permitted us to see Sandy Point, with its glittering sheet-iron houses, for a long time. In the morning we were off the northern shore of Dawson Island, and from this time until we reached Ushuaia the weather was extremely unsettled. Cold rains, drizzling fogs, and sweeping squalls of wind were the normal weather conditions. At 2 o'clock in the afternoon we anchored in Hope Harbour, a snug little cove at the entrance of Magdalene Sound. We soon assembled in small companies and went ashore to explore as best we could the regions about. Everything here had for us a special interest, for, in a scientific sense, all was unexplored. There were glac-

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iers, unscaled mountain heights, unknown water depths, and a savage wilderness of land, with gold in many streams. We should have enjoyed a prolonged stay here but the time for exploration in the more icy south was already far advanced, and since this was the principal part of our work we must hasten to it. The afternoon was given to examinations ashore.

The narrow beaches were lined with mussel shells and in one place there were two bee-hive shaped frames of old Indian huts. There were a great many birds about, but we saw no large life. Where the land was so exposed that the vegetation was sheltered from the sudden squalls of winds, here called "williwaws," there was a forest of large beech trees, and under these there was such a rank profusion of underbrush and moss that it was difficult, generally impossible, to force a passage. Near the open blast of the regular winds and the williwaws the land was mostly barren of trees but covered by a thick, velvety carpet of wet moss. It rained and snowed nearly all the time we were ashore, and we came back with our boots full of icy water, our clothing torn, soaked, and hanging to us like wet leather, and our heads bruised. We had made some notes and some studies, but altogether our personal discomforts were such that we were ready to throw science to the dogs. He who attempts to properly explore this region will find conditions to try his patience nearly as bad as at either pole.

On the following morning we steamed through Magdalene Sound. The scene was desolate but

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wildly beautiful. The westerly banks rose out of the waters with an easy slope, terminating in low hills of polished stones. The ravines, the gullies, and the shore-line were covered by a dense growth of stunted beech. The uplands, where soil and rooting surface was possible, were carpeted by heavy sheets of moss. The easterly banks, though far more barren, were of greater interest to us. Nine glaciers poured their crystal currents down from the majestic heights of Mount Sarmiento which was draped in a white mist. The glaring whiteness of these glaciers, separated by black weather-worn dome-shaped mountains of solid rock, made a scene of rare delight. At 11 o'clock we rounded Cape Turn, and then the interesting polished rocky slopes of the banks and islands of Cockburn Channel lay before us. Here we felt the disturbing influences of the airs coming out of the Pacific. A violent puff of wind struck us as we passed each break in continuity of the mountains, and this was followed by a rain squall and a choppy sea. We were indeed glad when we turned our backs to this region of battling storms to enter the less dreadful channels eastward. At 6 o'clock we were amid a labyrinth of uncharted islands in Whale Boat Sound. Severe storms came here also, and these, with frequent clouds of fog and increasing darkness, made navigation uncomfortable and dangerous. At midnight we dropped anchor on the eastern bank of Basket Island; but the bottom was rocky and both the wind and the sea were too dangerous to remain, so at 3 o'clock in the morning we started again to plod along as best we could.



An Ona Home.



Onas on the March.

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The chart was so imperfect that we were compelled to pick our way, as if exploring regions entirely new. We counted not less than twenty islands which we could not find on the charts. It would have been interesting also to linger here and explore this locality but we had a stronger interest ever pulling us on to regions farther south. As the sun rose and we advanced farther eastward, the atmospheric conditions were such that rainbows, complete and in fragments, were in the south and west almost constantly for several hours. The bows were generally arched over a chain of islands touched by bands of green and brown and gold, and altogether the effect was full of delightful colour and fascinating harmony.

At noon we anchored at the eastern end of Whale Boat Sound in a small bay on the northern shore of Londonderry Island. Soon after dinner we went ashore to bag specimens for the laboratory. The land around the bay is about a thousand feet high, rising rather abruptly from the waters, but the mountain crests are everywhere accessible. As we landed we found close to the water-line a number of old Indian fireplaces with great heaps of mussel shells about. These were the sites of ancient Indian huts. The lowlands were covered by a thick meshwork of vegetation, mostly mosses and grass. In sheltered places there were a few beech trees, but the tallest were not more than fifteen feet high. We had not ascended very far when we found everywhere evidences that the whole land had at one time been covered by glaciers. Massive boulders were seen in lines, and all the rocks were polished

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and scratched in a typically glacial manner. There were many lakes which marked the beds of old glaciers. Before dark we came down from the heights with our bags full of specimens and our notebooks full of observations, but our clothing as usual was wet and torn. Near the shore we built a camp-fire, and then tried to dry our clothing and extract such comfort out of life as Indians, in a similar position, do. I think it was Darwin who said that the people of this region did not enjoy any of the comforts of home. Certainly he never built a fire in a cold, drizzling rain, and sat beside it to eat his lunch. If he had, he should have learned to enjoy the first comfort of the home of primitive man. We spent a few days in this neighbourhood, visited a glacier, and then steamed through the northern arm of Beagle Channel to Ushuaia, where we anchored late in the evening of December 21. After breakfast on the following morning we went ashore. The manner of our going was a matter of some anthropological interest. It portrayed our developing disregard for formality and our resignation to the savage life to which a constant force of circumstances drove us. At Rio we were done up in good style before we left the ship; dress suits when necessary, the newest thing in neckties, and neatly pressed trousers. At Montevideo our garments were crinkled and showed the effects of the sea. We began, here, to be a little indifferent in personal appearances. At Punta Arenas we did not even try to fix up, but walked about the town as careless of dress as bricklayers; and here at Ushuaia, well—the man who dressed and



Ona Archery.

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brushed his hair was an outcast; he was not regarded as an explorer.

Ushuaia is a small town of about twenty-five sheet-iron houses, built at the base of the terminating hills of the Cordilleras. The background of the town is savagely picturesque. Two chains of mountains run eastward parallel to each other along the southern border of the main island of Tierra del Fuego, and these mountains give the surroundings of Ushuaia a remarkably wild but pleasing effect. The town has in itself very little of importance. It is a military and convict station for the Argentine Republic, and at present there is a pier in construction from which vessels can coal.

The government of the Argentine Republic with commendable liberality offered us coal and supplies free of cost at their stations. At Lapataia, a neighbouring town, the *Belgica* remained a week to coal. At Ushuaia and at Harbourn, we took in our last supply of fresh provisions. We were indebted to the Argentine government for the kind treatment at her hands, and to Mr. John Lawrence and Mr. Thomas Bridges (now deceased) and their families, for valuable aid in furnishing supplies and help in making Indian studies. It will not be possible to give more than a passing notice of our work among the very interesting tribes of Indians of this region. The anthropological observations, measurements and vocabularies will be given separate publication. For the present, the reader must be content with a few notes on the Onas.

CHAPTER VIII

A RACE OF FUEGIAN GIANTS



Comparative Size of an Ona
and a Caucasian.

HARBOURTON, Jan. 6, 1898.

THE Fuegians have been described, from time to time, since the country was first sighted and named by Magellan in 1520; but to-day they still remain almost unknown. In connection with the voyage of the *Belgica* we had unusual opportunities for studying their wild life and their

weather-beaten land. They are not, as it is generally supposed, one homogeneous tribe, but three distinct races, with different languages, different appearances, different habits and homes.

In the western Chilean channels, living in beech-bark canoes and in dugouts, using mussels, snails, crabs and fish in general as food, are the short, imperfectly developed Alaculoofs. These are met by many vessels navigating the Strait of Magellan and

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most of our reports of Fuegians are limited to hasty glimpses of these people; but they are now nearly extinct, and they were always the lowest and the most dejected of the Fuegians.

Closely allied in habits to the Alaculoofs are the Indians inhabiting the islands about Cape Horn and northward to Beagle Channel. These are called Yahgans. They have been the most numerous and the most powerful of the Fuegian people, but to-day they too are nearly extinct. They are dwarfed in stature, dwarfed in mental development and, like the Alaculoofs, live in canoes and feed upon the products of the sea.

The third tribe is a race of giants. They are called Onas by their neighbours, the Yahgans. The Onas have, thus far, evaded all efforts at civilisation, have refused missionaries, and have, to the present time, with good reason, persistently mistrusted white men. They have in consequence remained unknown.

The homes of the Onas are on the main island of Tierra del Fuego. For centuries they have fought to keep this as their preserve; but the Yahgans have been allowed to pitch their tents on the southern coastal fringe along Beagle Channel. In a like manner the Alaculoofs have been permitted to use the shore-line of the west. Neither the Yahgans nor the Alaculoofs, however, nor white men, until very recently, have dared venture into the interior. The great prairies of the north and the mountain forests of the middle of the island, with the still unknown lakes, have been guarded as hunting-ground exclusively for the Onas. The island is nearly as

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large as the State of New York. The boundary-line of Chile and Argentina, running from north to south through the centre of the island, gives each republic a nearly equal share of the country. Gold has been found in the sands along the beach of various parts of the land. This is being mined with considerable success. The pampas of the north and a part of the southern ground have proved to be some of the best sheep-farming country of the world. The gold-diggers and the sheep-farmers have thus re-discovered Tierra del Fuego as they have Patagonia. The mining camps and the wire fences are crowding the once ruling race of Onas into the useless forest-covered lowlands and the ice-covered highlands of the interior, where they must either starve or freeze or perish at the hands of Caucasian invaders. The old happy hunting-ground of the Ona has gone the way of all other Indian homes; but he has fought bravely for it, and he will continue to do so until the last skeleton is left to bleach on the wind-swept pampas.

The first sheep-farm was started here by Mr. Steubenrach, the British Consular agent, Punta Arenas. Steubenrach, anticipating trouble with the powerful Onas, who have always been the dread of white settlers in this vicinity, secured, as one of his shepherds, a missionary to preach the gospel and morality and some other things to the Indians. This mission service was a diplomatic stroke which was thought to be the most effective way of gaining the favour of the Chilean Government; which favour was a valuable aid in obtaining grants of land.



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It was also thought possible by this method to tame the aborigines and make shepherds of them. The good preacher tried to Christianise and civilise the Indians. During the day they congregated in large numbers to hear the new medicine-man. They were indeed interested; but they proved their interest in an unexpected manner. At night, when all was quiet and the shepherds were asleep, with confidence in the effect of their pious training upon the Indians, the wild hunters came among the herds, cut the wire fences, and drove off such numbers as suited their appetites. These night raids continued month after month, but the Indians came in fearlessly in increasing numbers to listen to the gospel powwows. At length, driven to distraction, the prospective makers of Christians sent to Punta Arenas for Winchester rifles. Preaching was then abandoned, and the murderous sound of firearms has taken its place ever since. The wire fences have been extended, the Winchesters have been multiplied, every available acre of Fuegian ground has been covered with sheep, while the Indians, never known and never understood, have been swept from their ancient homes.

In defence of the pioneers it should be said that the Indians from the first have waged a constant and relentless warfare. A mutual understanding has at no time seemed possible, and if the settlers would follow their business a vigorous defence was necessary. In spite of the destructive onslaughts of the Indians, however, the farms have flourished so well that to-day the number of sheep raised individually

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and collectively by the Fuegian rancheros is perfectly astonishing. There is one farm not yet quite stocked which will support six hundred thousand sheep. The profit over and above all expenses averages about fifty cents annually for each animal. This would give, for a farm of moderate size, a clear gain of \$50,000 yearly, which is certainly a princely income for a farmer. The proprietors of these ranches are mostly men of large finances, who live in luxury and comfort in the cities of South America and Europe.

The Onas, as a tribe, have never been united in a common interest, nor have they ever been led by any one great chief. They have always been divided into small clans, under a leader with limited powers, and these chiefs have waged a constant warfare among themselves. Up to the present they have had their worst enemies among their own people, but now that sheep-farmers and gold-diggers want their country, they are uniting to fight their common enemy. But this enemy, these white men with Winchesters, will be their doom.

The Ona population, is at present about sixteen hundred, divided into sixteen tribes of about one hundred each. From this number there is a constant diminution. Many of the children have been taken from their wild homes bordering on the sheep-farms, and placed in European families about Punta Arenas. These children thrive well at first, and are capable of considerable education, but few reach adult age. The minor children's diseases, such as measles and whooping-cough, are extremely fatal to them, and

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those who escape other diseases are almost certain to succumb to tuberculosis. For a number of years the Indians, watching the encroachment of white men upon their territory, have made it as uncomfortable as possible for the intruders. To bag a settler was quite as much sport as to secure game, and the white men in return have shot Indians with as much elation as if they were dropping panthers. Killing has been in vogue on both sides, but the battle is uneven. The Indian must vanish before the lead of Christians—such is the mission of modern civilisation.

Migration from one part of the island to another, and from one clan to another, has been common, but the Ona has seldom left his chosen land. A few have been found in Patagonia, and occasionally one has strayed over among the Yahgans and the Alaculofs; but these have only been stragglers who, by accident, have been separated from the main island. The Onas possess no canoes with which to cross the Strait of Magellan, or the canals south and west; but they barter with the other Indians along Beagle Channel and the west, and within recent years they have extended these trading operations to the white settlers along the south. The men have a great admiration for women of other tribes, and this admiration induces them to make raids among the other tribes to capture women. So much was this done in the past that in the south-eastern part of the island there sprang up a new race, a hybrid mixture of Yahgans and Onas; but these are now extinct.

Physically the Onas are giants. They are not,

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however, seven or eight feet in height, as the early explorers reported their neighbours and nearest relatives, the Patagonians, to be. Their average height is close to six feet, a few attain six feet and six inches, and a few are under six feet. The women are not quite so tall, but they are more corpulent. There is, perhaps, no race in the world with a more perfect physical development than the Ona men. This unique development is due to the topography of their country and the distribution of game, which makes long marches constantly necessary. The Ona men are certainly the greatest cross-country runners on the American continent.

The mental equipment of the Ona is by no means equal to his splendid physical development. He understands very well the few arts of chase which he finds necessary to maintain a food-supply. His game in the past has been easily gotten; his needs have been few, which fact accounts for the lack of inventive skill displayed in his instruments of chase. The home-life, the house, the clothing,—everything portrays this lack of progressive skill. Instead of the children being well dressed and well cared for, as is the rule among savage races, they are mostly naked, poorly fed, badly trained, and altogether neglected, not because of a lack of paternal love, but because of the mental lethargy of the people. It is the same as to shelter and the garments. They have abundant material to make good tents and warm, storm-proof houses; but they simply bunch up a few branches, and throw to the windward a few skins, and then shiver, complaining of their miserable existence.



Ona Hunter Ready for Action.

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It has never fallen to my lot to listen to a language so odd, so strikingly peculiar, as that of the Ona. Some of my companions on the *Belgica* used to amuse themselves at my expense by declaring that from a distance the talk of a group of Onas was like that of a group of Englishmen. To this I have protested, for that statement is certainly a libel upon English. This might be said, with considerable truth, of the Yahgan tongue, which is smooth and easy, but of the grunting, choking, spasmodic talk of the Onas it is decidedly untrue. Many of the words are not difficult of pronunciation, nor is the construction of sentences hard, but in every fifth or sixth word there is a sound impossible of reproduction by any one who has not had years of practice. These sounds offer sudden breaks in the flow of words and the speaker, by efforts which suggest the getting of sounds from the stomach, struggles for something far down in his throat. He hacks, and coughs, and grunts, distorting his face in the most inhuman manner momentarily, and then passes on to the next stumbling block, or hot potato, or whatever it is which makes the poor mortal suffer such tortures of speech. I always felt like giving an Ona an emetic when I heard him talk.

Like all the American aborigines the Onas feed principally upon meat, and this meat was, in former years, obtained from the guanaco. The guanaco roamed about in large herds upon the pampas and grassy lowlands; regions now in use as sheep-farms. The guanaco, like the Indian, is forced to the barren interior mountains, where life is a hard struggle against storms and barrenness and per-

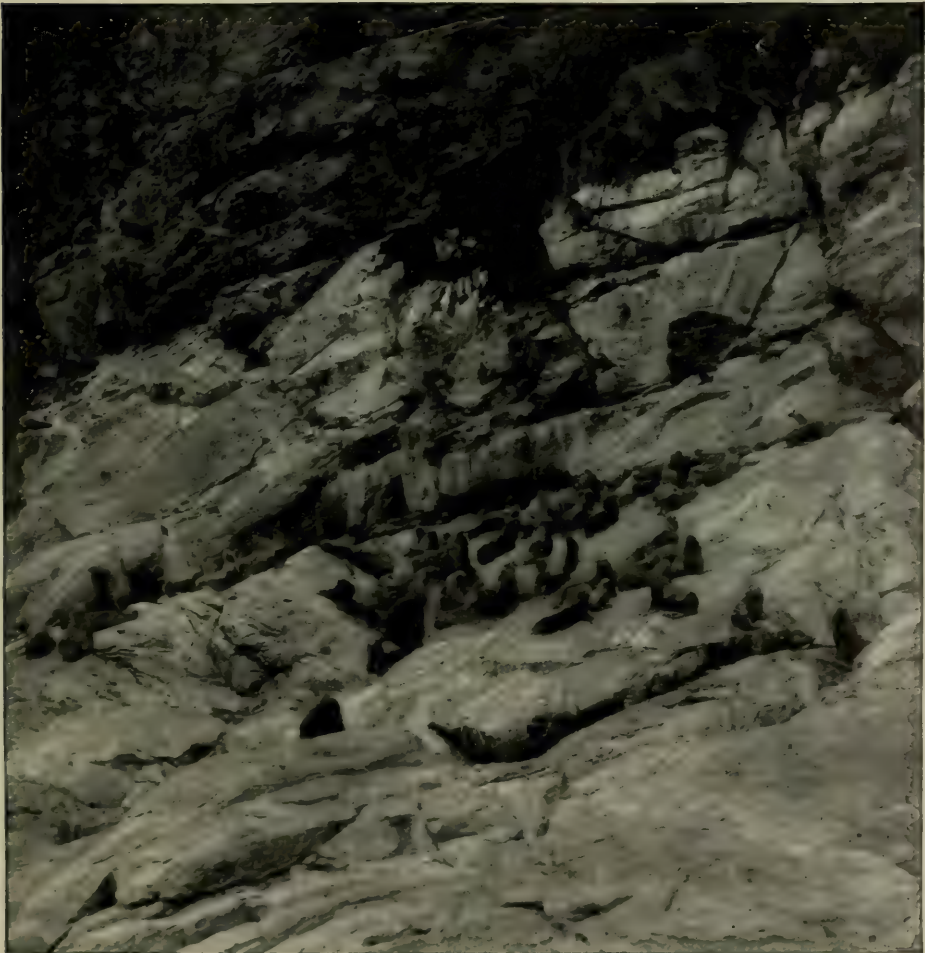
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ennial snows. Owing to the present greater difficulty of hunting these animals and their reduced numbers, the Ona has taken most naturally to the sheep which have been brought to occupy these lands. That the sheep are owned by other men is a fact not easily recognised by Indians, to whom the world of Fuegian wilderness has always been free. The many thousands of *guanaco blanco*, as the Onas call sheep, grazing peacefully upon the Indian hunting-grounds, make a picture full of irresistible temptation, as the aborigines, hungry and half naked, look from icy mountain forests down over the plains. Shall we call them thieves if, while their wives and children and loved ones are starving, they boldly descend and, in the face of Winchester rifles, take what to them seems a product of their own country?

Unfortunately, the Indians have had so many causes for revenge against the white invaders, that they no longer capture sheep, as they did primarily, to satisfy the pangs of hunger, but to obtain vengeance. The wholesale manner in which they do this, however, would make a beggar of an ordinary farmer in a single night. In the neighbourhood of Useless Bay they have been known to round up two thousand sheep in one raid, and they seldom now take less than a few hundred at a time. While stopping at a farm on the Rio Grande I had an opportunity of being in close proximity to this kind of warfare. Two Indians came in and asked for an interview with the chief of the farm. The man in charge was a bright young fellow who knew the



A Bull Sea-Lion at Rest.
(*Otaria Jubata.*)



Den of Sea-Lions, Staten Island.

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Indians very well. He treated the delegation kindly, fed and clothed them, and listened to their story.

The Indians spoke in broken Spanish, and said that they had been sent by the great chief Colchicoli to ask if the manager of this farm would make an arrangement for amicable and peaceful relations in the future. Colchicoli and his people had, for a long time, been on friendly terms with Mr. Bridges, a farmer on the southern shore. While here, many had died and many others were sickly. It was the wrong season for them in the south; the winter was too cold there, the spirits were against them, and for reasons of health alone they must seek their old haunts on the sunny northern shores for the winter. They had been ten days in crossing the island over the snowy interior mountains. They had been several days without food. The women and children were starving. The entire tribe were at the edge of the forest about one hundred miles to the south. Would Mr. Menendez give them a little food for present needs, and a preserve where the people might live and hunt in their own way, undisturbed by the soldiers and the shepherds?

Mr. Menendez replied in the affirmative, and then went on to qualify his offer. He said that at first he was not inclined to treat their demand seriously. He had suffered so much at their hands by unlimited thefts of so many thousands of sheep, and by their heartless destruction of his fences, etc., that he was not in an easy mood to harbour them near his farms; but if they promised to be good, if they

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agreed to steal no more sheep, he would give them the southern bank of a river, about ten miles southward, where they might pitch their tents, hunt and fish, and live undisturbed. He further agreed that he would give them such meat as they required.

The Indians returned to their chief to report the success of their mission. Owing to their lengthy stay, however, the chief thought they had been killed, and in retaliation ordered the raiding of five hundred sheep which, of course, made the consummation of an amicable agreement impossible. In defence of the Indians, however, it should be said that one year previous a similar arrangement had been entered into in good faith. The Indians came, trustingly, to a camp where the entire company, men, women, and children, were seized by soldiers, and exiled from the island.

The Onas have been masters of Tierra del Fuego, not because of the perfection of their implements of war, but because of their splendid physical force. The only destructive weapon which they have brought to effective use is the bow and arrow. The bow used by them is made of the wood of the antarctic beech, which is scraped and worked into the desired shape by the sharp edge of one of the numerous shells which everywhere are found on the beach. The string is made of the sinews of the guanaco, neatly braided. The arrow shaft is a reed-like branch of a tree called the Winter's bark; it is winged with feathers of native birds, and tipped with a unique glass point.

In former years, before vessels entered the Strait

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of Magellan and before the passage around Cape Horn was discovered, the Onas tipped their arrows with flint; but since white men have invaded these waters their misfortunes have been the fortunes of the Indians. From the many wrecks thrown upon the rocky shores during the past three hundred years the aborigines have obtained glass, with which they now point their arrows; and also iron of which they make knives. Within the last twenty-five years they have occasionally bagged an unwary gold-digger, and his kit has been added to their own imperfect implements of chase. But they have never been able to obtain ammunition, and so the rifles in their camp are of no use. The traders and farmers on the border lands, with whom these Indians have to come in contact, have always been alive to their own interests. They have prudently refused to sell firearms or ammunition. If the Onas were able to obtain guns and supplies they would clear their island of pale-faced settlers in less than a month.

With the bow and arrow as their sole implement of chase the Onas roam about, always in the footprints of the guanaco, from the barren interior mountains to the forest-covered lowlands, and during the winter from the forests over the pampas to the sea shore. If they fail in securing their favoured game, the guanaco, they capture a kind of ground rat or gather the snails and mussels of the beach; but the one aim of life is to hunt guanaco.

I wish I could paint a picture or secure a photograph of this chase. It is certainly a most charming bit of aboriginal life. Day after day, the whole

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family marches over wind-swept plains, through icy streams, into regions seemingly ever deserted by animal life. The women and children travel in one group, generally in gullies, winding around low hills where they are out of sight of the game. The men scatter about as sentinels, mounting little elevations now and then, to search, with their eagle eyes, the undulating plains for a herd of guanaco. When on this weary chase they are always hungry and generally but half-clothed. The sick and the helpless aged are left by the wayside to starve or support life as best they can, while the more vigorous individuals go on and on famine-stricken until they come upon their game.

When in sight of guanaco the men seek to surround the entire herd by creeping on hands and feet and covering their bodies with a robe to imitate the animals. As they close in on them they rise, drop their robes, and spring naked upon the guanaco, killing such as they can with arrows. Then, as the animals stand in utter amazement, they rush upon them with knives and clubs. In this onslaught they often secure the entire herd. Next, a gluttonous hilarity begins, which knows no bounds. It continues while the meat lasts and then famine is again their lot. Thus their life is one of short feasts divided by long famines.

The matter of clothing with the Ona is a very simple affair; although the climate of their region is cold, stormy and even humid, they are very imperfectly dressed. The children run about in the snows either naked or nearly so. The men have a large



Dr. Frederick A. Cook.

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mantle made of several guanaco-skins sewn together. This reaches from the shoulders to the feet, but it is not attached by either buttons or strings; it is simply held about the shoulders by the hands. The woman, when well dressed, wears a piece of fur attached about the waist and another loosely thrown about the shoulders, but she is not often well dressed and must generally be contented with a kind of mantle, carelessly suspended from the shoulders, which is allowed to fall upon the slightest provocation.

Nothing could be less like our idea of a home than an Ona house. It is proof to none of the discomforts of Fuegian climate. Rain, snow, and wind enter it freely, for it is a simple accumulation of tree branches thrown together in the easiest possible manner. Sometimes it has a conical shape, but more often it is only a crescent or breastwork, behind which the entire family sit or sleep. To the windward are thrown a number of skins to keep out the full blast of the wind, but from overhead the cold rains drizzle over poorly clad bodies, while the ground is always uncovered and cold. In the centre of this circle of shivering humanity, or just outside of it, is a camp-fire which, however, serves better for cooking purposes than for heating. The arrangement of the house is such that the heat all escapes. At night the fires are allowed to go out, and the adults, lying in a circle, place the children in the centre, with blankets of guanaco-skins spread over all. To keep the blankets from being blown off, and to add additional warmth, they next call the dogs, who take their positions on the top of the entire mass of quivering

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Indians. In former years it was a poverty stricken family who had not enough dogs to cover it out of sight; but the shepherds have now killed the dogs, and the Indians must rest cold and comfortless without their canine bedfellows.

There seems to be considerable love expended among the members of an Ona family. It is kindled with the first days of childhood, and it is still burning at ripe old age. It is, however, a love which is never appreciated by a white man, nor is it ever tendered to him except for little spasmodic periods. Nothing illustrates this point better than the experience of the pale-faced new-comers. Everybody who goes as a pioneer to the Cape Horn region is a bachelor. All buy, borrow, or steal wives when they decide to settle down upon a gold-mine or a sheep-farm. The Indian women, it must be confessed, are not unwilling to be bought or stolen, but they are not to the white man what they are to the copper-faced rival. In the Indian household she may be but one of several wives; she can claim only a small share of her husband's affection; she must work hard, is poorly dressed, and is always half-starved; but she prefers this life as a steady thing to the entire heart of a pale-face, with the luxuries which he brings her.

One miner, a man with considerable experience and a collegiate education, gave me the following story bearing on the behaviour of the women of Fireland:

"The Ona girl is a queer and unnatural being; she may live with a white man, or even be lawfully



Sunset Over Brabant Island.

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wedded to him, but tender sentiments like love for her white admirer never enter or leave her dusky bosom. I came here ten years ago and struck a pay dig. I hadn't time to go home to look for a new or to bring out an old sweetheart. Some Indians always remained unfriendly, but a few came with good intentions to the camp; these would now and then leave one or two of their wives for me to feed and dress, and in this way I learned to like them. One day there came to the camp an old couple with a young and bewitching daughter. She was only fourteen years old, but in form and manner she was just the jewel a gold-digger would be likely to pick up. I knew a little smattering of the native lingo and began to talk love to the girl at once; she didn't seem to understand me. All the tender and nice things I tried to say seemed to be wasted. I talked to the parents; they quickly understood me, but they said a red woman might admire and respect a pale-face, but the warm fire, which was the principal charm of an Ona woman, was never kindled by a white man.

"In a short time I had learned to love the girl, and she didn't seem to hate me, so I asked the parents if they would not leave her with me for a while that she might learn to like me, but they objected, whereupon I determined to steal her. After a lonely walk one evening in the forests, she agreed to be stolen. When the family left for the mountains I followed and picked the apple of my eye. Things went along happily—the honeymoon was a short dream, and the parents, for a long time,

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did not come to disturb me. I congratulated myself upon the success of my theft. Later, however, I learned that the parents knew about it all the time. I dressed the girl in expensive clothes, for which I had sent three thousand miles; fed her three full meals daily; built a nice warm hut; and did nearly all the camp work myself. She had not been fully dressed before, never had more than one meal a day, sometimes not one square fill in a week, and at home she always worked like a slave, shivering out a miserable, homeless existence in the forests. I showered her with luxuries and kind, gentle treatment.

“By this means, and by another which I shall mention presently, I was generally able to keep her as a permanent fixture about my household. About once a week, however, she found it necessary to go into the forests to gather certain fungi, which she said were necessary for her health. At first she returned promptly from these little jaunts and she always seemed livelier and refreshed by the recreation, but later she remained away one or two days at a time. This absence I could not endure, so I sought the reason for it and found that she was meeting a big, manly young buck. I could not blame her for being enamoured with him for I admired him myself. I took him into our camp and ever since there has been peace, and restfulness, and divided love in our wild home.”

This suggests a consideration of the aboriginal marriage relations, and the arrangement of the bonds of the family institution. Marriage, like almost

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everything Ona, is not fixed by established rules. It is arranged and rearranged from time to time to the convenience of the contracting parties. Women generally have very little to say about it. The bargain is made almost solely by the men, and physical force is the principal bond of union. For ages the strongest bucks have been accustomed to steal females from neighbouring tribes, and from neighbouring clans of their own tribe. The Onas being by far the most powerful Indians, have thus been able to capture and retain a liberal supply of wives. This easy gain of women has made polygamy a necessity, and the system is not condemned by men familiar with the people. A missionary who has been in constant contact with these Indians for thirty years gives it as his opinion that a plurality of wives was entirely satisfactory to their peculiar emotions and habits of life.

The relation between the women who possess but one husband in common in the family wigwam is of novel interest. As a rule, they are no more jealous of each other, or of their husbands, than our children in the home circle. The principal reason for this is that the several wives are often sisters. A young man takes by force, by mutual agreement, or by barter, the oldest daughter of a family. If he proves himself a good hunter and a kind husband, the wife persuades her sister to join her wigwam, and share her husband's affections. Frequently, when a girl is left an orphan, she is taken into a family and trained to become the supplementary wife of her benefactor in after years. In the hut each wife has

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her own assigned position, always resting in exactly the same spot, with all of her belongings about her. The wealth of the household is not common to all the occupants. Each woman has her own basket of meat fragments or shell-fish; her own bag with implements, needles, sinews, and bits of fur, and each wife has her own assemblage of children.

The unwritten laws which govern the actions of the tribe as a whole are very vaguely understood. There never has been any very great need for the Onas to assemble and unite against an enemy. Any one of the numerous clans under one chief has been more than equal to overcome the feeble onslaughts by other Indians and white men. Hence the lack of tribunal organisation. In the family, however, the relations are firmly fixed by habits which never change. The loose arrangement of marriage and divorce does not seem to disturb seriously the equilibrium of the home circle. The camp is pitched from day to day at convenient spots for the chase. This makes elaborate houses or complex fixtures impossible. It never requires more than a half hour to build an Ona house. The work of the man is strictly limited to the chase. He carries his bow and quiver of arrows; and his eye is ever on the horizon for game; but he seldom stoops to anything like manual labour which is not connected with the actual necessities of the chase. He kills the game, but the wife must carry it into camp. In moving the women take up all of their earthly possessions, pack them into a huge roll, and, with this firmly strapped across their backs, they follow

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the unencumbered load of their brave but ungallant husbands. Thus the women carry, day after day, not only all the household furniture, but the children and the portable portions of the house. The women certainly have all the uninteresting detail and the drudgery of life heaped upon them, but they seem to enjoy it. In defence of the men it should be said that they are worthy husbands. They will fight fiercely to protect their homes, and they will guard the honour of their women with their own blood. It is a crying sin of the advance of Christian civilisation that this redman of the far south should be compelled to lay down his life at the feet of the heartless pale-faced invaders, to shield the honour of his home.

I doubt if regular missionary work will improve the hard lot of this noble band of human strugglers. The efforts thus far made have certainly had the contrary effect, and altogether they do not need a new system of morals as badly as we do ourselves. I do not mean to infer that missionary work, in general, is hurtful to aborigines. There is a legitimate field for such efforts, but it is not among Onas, unless the work is conducted in a new manner by a thoroughly practical man. They need to be placed in a position where they may follow their wild habits without the infectious degeneration of higher life. Individually and collectively they have fewer sins than New Yorkers. It is true that there are among them no faultless characters, but there are also no great criminals. There are some good and others bad, but the worst and the best are found side by side.

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The bitter and the sweet of human life among them, flows in the same stream. It has the same origin, and the same termination. The lesson of ages to untutored man has impressed upon him a prescription of moral direction, which is quite as good as and far more appropriate for him than the white man's code of ethics.

CHAPTER IX

DISCOVERIES IN A NEW WORLD OF ICE

ON January 3, 1898, we started eastward through Beagle Channel, intending to push southward at once, but an incident happened which changed our progress and also disturbed our ease of mind. This incident proved to be the *Belgica's* first geographical discovery. While trying to find Harbourn, a missionary station on the south-eastern shore of the main island of Tierra del Fuego, she struck a reef.

We were steaming eastward through Beagle Channel. It was late at night, and before us there was the dim outline of a long panorama of islands; behind lay the ice-covered mountains of the tail of the Cordilleras. On each side were the black forest-covered steeps of the wild and melancholy Fuegian Islands. At 11 o'clock the twilight was still pouring over the white glacial sheets of the west; the tops of the islands were aglow with a curious pearly light. The water was as smooth as that of the Hudson, but deep down rested the feeble white reflections of the mountain heights. The coastal outline was indeterminable. We pushed along slowly, search-

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ing bay after bay for some signs of human life. On a neck of land an object was reported which might be a house, but we could not decide the question even with our best telescopes. We aimed for it. In a few minutes we discovered that our progress through the water was arrested. This was a mystery to us. The engines were forced to their limits, but we remained stationary. Soundings indicated that we were aground on a reef of rocks, but we had gone on so easily that no one had felt a jar. We hoped the tide would rise and lift us off, but it fell and left us stranded. At 4 o'clock in the morning the *Belgica* began to careen, and at 6 o'clock she had a list, making it impossible to stand on the floor. We tried to brace her up with spars, but they broke like pipe-stems. We now made out the object on shore to be a house and saw also some signs of life about it. Presently a group of men came from it to us. They were Indians, under the direction of Mr. Lucas Bridges, a sheep-farmer. Mr. Bridges volunteered to help us in our efforts to save the ship. I went ashore with him to get the services of as many Indians as possible. The sailors and the Indians, working side by side, began at once to lighten the ship by removing cargo to the shores. Only two or three boat-loads were landed when a sudden storm rolled down the gullies from the high mountains to the north-westward, piling up a sea which made further communication with the ship impossible. From the shore we could see the *Belgica* rock and roll in response to every gust of wind which passed over us. On the shore and on the



Mount William, Antwerp Island.



Mount Allo, Liege Island.

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ship there was little hope of saving the vessel. Following a tremendous squall we saw the Belgian colours go up and then felt relieved of fear. She drifted with the wind and in an hour disappeared behind a black head of land. The next day she returned and reported no serious injury.

From Harbourn we steamed eastward to the storm-washed shores of Staten Island, where we took our last water-supply, and bade our friends and the known world a final adieu. From the time we left Staten Island, on January 13, 1898, until our return to Punta Arenas, on March 28, 1899, we were in another world—a new icy world, where communication with home regions was impossible. We had troubles of our own, and a little warfare, too—but we were totally ignorant of the Spanish-American War, the Dreyfus case, and the other great national and international troubles which had made history in our absence.

Our first large task was the seemingly impossible work of making a map of the sea bottom and a study of the waters south of Cape Horn. This is a belt of ocean famous as being swept by the most destructive storms on the globe. It is difficult enough for ordinary navigation, but to attempt to remain stationary for three or four hours daily, and sink a wire two miles, with delicate instruments attached, was a venture which did not appeal to us with much promise of success. We were favoured, however, with good weather until we got a glimpse of the South Shetland Islands, and were thus able to make a line of soundings across the previously unfathomed sea. The

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general depth here was considerable. After passing over a narrow submarine shelf south of Staten Island, the lead dropped suddenly to 13,300 feet. The ocean-bed then rose gradually in an easy slope to the South Shetland Islands, thus proving a rather sharp disconnection between the mountain-ranges of southern South America and those of the imperfectly known antarctic lands.

The first iceberg was met the day before we saw the snowy outline of the South Shetlands. It appeared a long way off, over our port bow, at about 8 o'clock in the evening of January 19th. We all went on deck to get a glimpse of our first antarctic berg, but we made no efforts to get nearer. The sky was sooty, and the air so heavy that the coming twilight was lost in a gloomy mist. Around the dull white mass there was a cloud of vapour which rose and fell, now offering a peep at the strange block of ice, and again veiling it from view. Half sorry to leave it without further observation, we steamed onward until it sank into the stormy sea over our port quarter.

The night which followed was dark. The sea rolled under our stern in huge inky mountains, while the wind scraped the deck with an icy edge. We kept a sharp lookout for icebergs, which might come suddenly into our path out of the impenetrable darkness ahead. The sudden fall of the temperature and the stinging, penetrating character of the wind seemed to warn us that ice was near; but we encountered none. Life was plentiful, but melancholy. Curious albatrosses and petrels hovered about us, uttering strange cries, and in the water there was an occa-



Weddell Sea Leopards of Belgica Strait.

(*Leptonychotes Weddelli.*)

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sional spout from a whale. It was a night of uncertainty, of anticipation, of discomfort — an experience which only those who have gone through the wilderness of an unknown sea can understand.

The morning dawned, as it usually does over Cape Horn seas, without the sun, and with a smoky, low, lead-streaked sky. At noon the icy mist overhead melted and an occasional sunburst gave life and colour to the scene. Our soundings indicated a proximity to land, which caused us to skim the horizon constantly through our glasses with keen interest. A small white speck here and there indicated distant icebergs. At about three o'clock in the afternoon a series of low pyramidal masses appeared under the southern sky. It was like a bank of blue fog fringed with snowy bands. The whole length of our seaboard formed an ill-defined, cloud-like aggregation resting on the black waters and extending the entire length from north-east to south-west. As we steamed on, the central groups became more distinct and the whole line rose above the horizon. We now recognised it as the northern exposure of the South Shetland Islands. During the afternoon a gentle but piercing wind came from the land, bringing with it a glassy air and an easy, silvery sea, over which the new land stood out in bold relief. We could distinguish Livingston Island over our port bow, and north-eastward, melting into the blue airy distance, were numerous similar islands. Over our starboard bow was Smith Island, its base still under the water, and its table-topped crest rising into mouse-coloured clouds, sixty miles away.

We hoped that the night would not again be

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darkened by the ever-present black mist, and pushed rapidly landward to get a good view before midnight. But this was not to be, for as the sun sank in the south-west the wind came out of the north-east with a sooty smoke which blocked out our horizon. The distance was too great to make a good study of the land. In a general way this coast-line resembles the northern parts of the Greenland landscape. About the largest islands there are many small, ice-free isles, or rocks, which serve as resting-places for seals, penguins, cormorants, and gulls. On the larger islands, and especially on Livingston Island, there are high peaks and rounded, dome-like hills, which are crowned with snow, but whose sides are mostly bare and wind-rasped. The valleys are filled with huge glaciers, which send tongues out to the sea. We saw no glaciers, however, which came out from any distance into the water. The limit of the ice was generally at high-water mark, where it wasted away in small fragments. From what we later learned of the lands farther south, it is extremely probable that moss and lichens are here abundant, but there is no hope for grass or trees.

It is very curious that this group of islands, about one hundred in number, with a thousand miles of accessible coast-line, and several good harbours, free of ice for much of the year, should remain unclaimed by any government, and unsettled by human efforts. It would be a humane mission if our government would take possession of these islands, and place there a light-house, with a supply station, for the preservation of ship-wrecked sailors. Vessels are

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lost in this vicinity almost every year, and we do not know but that some poor seamen are not now stranded on one of the many desolate islands, awaiting the relief which never comes.

During the night of the 20th, the ship was kept moving slowly southward. It was another night of anxiety, though there were few icebergs about, and no pack-ice; yet the proximity to an unknown coast and the uncertainty of our position, with unsettled weather, made us all but comfortable. In the morning it was misty. Numerous small icebergs were about us, and while trying to dodge these we made another discovery — we struck a rock. This time we did not go on to it as easily as we did in Beagle Channel. We struck with a force that made the ship tremble and crack from stem to stern. We needed no call to come on deck, but after reaching it, we could not see what had happened.

“We struck an iceberg,” some one said.

“Yes; a black one,” said Knudsen.

A few moments later the fog lifted, and we saw white crests and black rocks about us on every side. The good old ship was turned; she rolled off and struck two or three other rocks, and then steamed away, none the worse for it. As we withdrew we watched the small icebergs being dashed to pieces on the same rocks, and wondered if that would not be our fate with the next encounter.

At about noon on the 21st, the horizon cleared a little, giving us an opportunity to pass safely from the rocks and bergs around us. Sail Rock was visible

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on our port, but nothing else except the dim outline of Deception Island and the rocks eastward. Sail Rock is remarkable from a distance; it has the appearance of a ship under sail; but at close range it is more like a house with a gable-roof. It is a solid rock about four hundred feet high, a thousand feet long, and five hundred feet wide. The sides for three or four hundred feet are perpendicular, offering no beach, and no ledge as a resting-place for birds, except at the peak. As we had Sail Rock over our quarter, the weather changed; the bright gray of the waters became black, the sky grew lead-coloured, and penguins jumped out of the water and then rushed through it landward with electric swiftness, as if to warn us of a coming storm. The storm, however, did not come until the morning of the 22d.

This storm proved to us a melancholy affair. The wind at first was not strong or steady, but the sea which rolled under our starboard quarter tossed us about upon its bosom as a child does a toy. Occasionally it broke over us amidship, flooding the laboratory and the galley. There was a large quantity of coal on the decks, and some of this was carried by the swash into the scuppers, making escape of the water impossible. To free the scuppers one of our youngest sailors — Wiencke — was at work periodically during much of his watch. In the afternoon the tempest increased and gathered force hour after hour. Great seas broke over us with increasing violence, while the wind came and went with a cannon-like roar. Everything movable on the decks



Cormorants at Home.



Arctowski gathering Geological Specimens, observed by a Megalestris.
(Cape Lancaster in the Background.)

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was swept overboard. At about three o'clock in the afternoon Amundsen and I were on the bridge, straining our eyes and levelling our glasses on a mysterious black object ahead, directly in our course; while thus engaged, we heard an unearthly cry,—a cry which made me shiver because of its force and painful tone. We turned about quickly, but saw nothing to indicate the direction of the noise. Amundsen, thinking there had been an accident in the engine-room, rushed in that direction. I went aft to the quarter-deck, and, looking astern, saw a man struggling among the foamy crests. It was Wiencke—in trying to free the scuppers he had lost his balance, and in falling, he had uttered the awful cry which had startled us. With quick presence of mind he sought the log-line and grasped it. I caught hold of the other end, and began to draw it slowly in, but he slipped until his hand was stopped by the log; upon this he held with a death-like grasp. Before I had pulled in the full length of the line everybody was on deck; but there was little to be done. With the sea tossing the ship about like a chip, and the wind blowing a gale, it was impossible to lower a boat. As I brought Wiencke close to the stern, Lecointe, with a bravery impossible to appreciate, volunteered to be lowered into the icy sea to pass a rope around the poor fellow. He followed his offer with demands for a rope, which was securely fastened around his waist. With two men at the rope, Lecointe was lowered into the churning waters, but he sank at once with the counter-eddies, and nearly lost his own life without

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being able to keep near Wiencke. Lecointe was raised, and without delay or undue excitement, we managed to tow Wiencke to the side of the ship, where we expected to lower another man. But while we were doing this, he gave up his grip on the log and sank. We waited there for an hour, but saw no more of our unfortunate shipmate. Wiencke was a boy with many friends, and his absence was deeply felt in our little party.

Before night the fog raised, and exposed under it a continuous wall of ice about one hundred and fifty feet high, extending as far eastward and westward as we could see. At first we thought it an iceberg. It had every resemblance to one, but its enormous size led us into doubts. We steamed eastward, keeping from it a distance of about four miles, and presently were able to make out a black line above the water, which later we determined to be rocks. Around the eastern termination were a number of small peaks of volcanic rocks, and from them came, first the odour of guano-beds, and then the deafening squawk—*gha-a-ah, gha-a-ah*,—of countless millions of penguins. This was Low Island. We rested here in the lee of its walls for the night, but owing to persistent fogs we did not get a glimpse of its interior.

On the morning of the 23d the sea was easier but choppy, and the weather offered promises of clearing. We took advantage of the conditions to cross Bransfield Strait, which separates the South Shetlands from the mainlands of the true antarctic.



A Penguin Rookery, Isle Cobalescou.



Penguins — A Family Gathering on the Pack-ice.

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The promise of a clear horizon was not realised, for it remained misty all day. Icebergs were passed in great numbers, most of them being table-topped and square cut, with great blue lines, crevasses, and cavities. The mist destroyed the fine outlines and the fascinating colours of the ice. The knife-like corners of the crowns were ill-defined, and the usual exquisite blues and greens were covered by the gloomy gray of the sky. There was about these bergs, even with their subdued colours, something wildly picturesque, but there was also a real danger in our proximity to them in hazy weather.

Historically the record of our predecessors in the region which we are about to enter is short. Early in the twenties the islands about Cape Horn and the South Shetlands were besieged by American fur sealers. They did their work of execution so thoroughly that in the short period of five years almost the entire race of fur seals was exterminated. One of these sealers, Captain Nathaniel Palmer, in a little shallop of forty tons, while seeking new sealing grounds southward, found an extensive country covered with ice and inhabited by penguins and seals. Some years later Captain Biscoe, a British sea-elephant hunter, saw a part of the same country somewhat farther to the south-west, and still later a German sealer, Dallman, saw a part of the same northern coast. To Palmer belongs the honour of the discovery of this vast tract of land. It is a disappointment that his records are so imperfect, but the record of everything antarctic is of a similar nature. Palmer has been forgotten by his own coun-

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trymen and ignored by foreign cartographers. In the arrangement of the new chart the Belgian Expedition will attempt to place his name where it belongs—on the land which he saw first of all men.

At 3 o'clock in the afternoon of the 23d a curious white haze appeared upon the southern sky. A little later an imperfect outline of land rose into this haze. It extended as far as we could see to the east and to the west. The top was everywhere veiled by a high mist, and this mist had within it a mysterious light, which is one of the most startling of all the south polar effects. As we drew nearer we noticed that the land was not as it at first appeared, an endless wall of ice, but rough, irregular and disconnected, though it was buried under a mantle of glacial ice, extending to the water's edge. Here and there were large bays, and one directly over our bowsprit was so wide that it offered us a tempting path southward. Now the maps were carefully studied that we might be able to fix our position on paper; but in this effort we failed.

Over the starboard bow rose two beautiful headlands, mountains of moderate height, perhaps two thousand feet; the first (Mount Pierre) having around it a circular cloak of ice extending from a black crown of rocks at the summit to the sea-line, where it terminated in a perpendicular wall of ice of about one hundred and twenty feet in height. The second (Mount Allo) had a similar form but was much more heavily laden with snow. In front of these remarkable headlands there was a bay, and beyond a long series of mountains, clothed in the

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same sheet of perennial ice. Eastward there were a number of small islands, mostly free of ice, and beyond, low under the south-eastern sky, was the dim outline of an extensive white country. We set our course somewhat east of south to examine the interruption between the high mountainous land before us and the more even country eastward.

That the reader may better understand the positions I will give the names, which have since been affixed to the discoveries, as we steam along through the undiscovered country.

We headed for a small island (Auguste Island), steaming slowly; for with the ordinary lead we found no bottom to the sea, and being in absolutely unknown water we might at any moment strike a reef, as we had done twice before. It was ten o'clock at night before we were near enough to make a landing. Then a boat was lowered, and into it we piled, eagerly seizing the first opportunity of our mission to study the antarctic lands and life. It was a curious night. Everything about us had an other-world appearance. The scenery, the life, the clouds, the atmosphere, the water—everything wore an air of mystery. There was nothing in our surroundings which resembled the part of the antipodes with which I was familiar. Greenland and antarctic landscapes are apparently as widely different as the distance between them.

Though the sun was sliding eastward just under the high mountains to the south-west it seemed perfectly dark. Nevertheless, on the water, as we paddled over it, there was a curious luminous gray light, by which it was possible to read coarse print even at

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midnight. This light rested on the new lands to the east and west, and brought out the snowy outlines so perfectly that it was possible to take photographs throughout the night. The sky, however, continued black, made so by the sooty clouds which ceaselessly rose out of the Pacific to drop their white cargoes of snow on the neighbouring lands. There was at this time no wind. The water was smooth and glassy, the land far off and restful; but the life was otherwise. Awe-inspiring and strangely interesting were the curious noises of the cormorants, the penetrating voices of the gulls, the coarse *gha-a-ah*, *gha-a-ah* of the penguins, the sudden and unexpected spouts of whales, the splash of seals and penguins, and the babyish cries of the young animals on the rocks before us.

There was nothing remarkable in the appearance of this land upon which we were about to embark. It was a heap of hard rocks, mostly granite. The northern exposure was bare, the ravines were still levelled with winter ice, and the southern point had on it a small ice-cap. We afterwards saw a hundred others of a similar nature, and all will pass under the same description. We landed in a small bight, upon a ledge of rocks. I think Arctowski, with his hammer and geological bag, was the first to step ashore, and he was followed by Racovitza, with his paraphernalia to capture natural history specimens. Gerlache and I next stumbled over fragments of ice, and stones and impertinent penguins, who disputed our landing. We wished to get a view of the new land, but the force of the swell was such

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that we were compelled to return to the boat and push away from the rocks to save it from being smashed.

We rested on the oars while Racovitza and Arctowski did the honours of the expedition; we tried to follow them with our glasses as we rocked about in the boat, but soon lost sight of their movements in the darkness. We were able to locate Arctowski by the dull echo of his hammer, and we were able to trace Racovitza by the chorus of penguins which greeted him from rock to rock. The alternate interchange of the music of the hammer and the war song of the penguins was an entertainment which to Gerlache and myself, will be a long and weird remembrance. At about midnight we returned to the rocky ledge to pick up our companions with their loads of rocks and bags of game. The inhabitants did not like their visitors. The penguins assembled about us, picking at our feet; the gulls hovered threateningly about our heads; and even the harmless cormorants dashed to and fro over us, stretching their long necks to ask our mission. Worst of all the sea-leopards clambered over the rocks near us, snorting and defiantly showing their teeth and rolling their large, glassy eyes. As we left it was too dark to see the movement of an animal one hundred yards from shore, but the peculiar whiteness which rested on the scene made it possible to take a photograph of the island with good details.

During the few hours of night we rested under easy steam, and in the morning we found ourselves well into the bight (Hughes Inlet) which we had

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entered. The land before us retreated and offered even greater hopes of a passage southward. At five o'clock the sun had already risen over the snowy heights of the east and was under the banks of black clouds which sailed out of the west. There was a solitude and restfulness about this sunburst, and the new world of ice under it which is difficult to describe. Our position at this time was in the centre of a wide waste of water, about twelve miles away from the nearest land. We were too far from the rocks to see birds, and except for an occasional spout of a whale there was nothing to mar the dead silence. A strange pang of loneliness came over us as we paced the deck. There were indications of channels to the south and west, but from the distance at which we reviewed the lands every projection seemed a continuous mass of impenetrable crystal solitude. Could there be a place more desperately silent or more hopelessly deserted?

CHAPTER X

DISCOVERIES IN A NEW WORLD OF ICE

(CONTINUED)

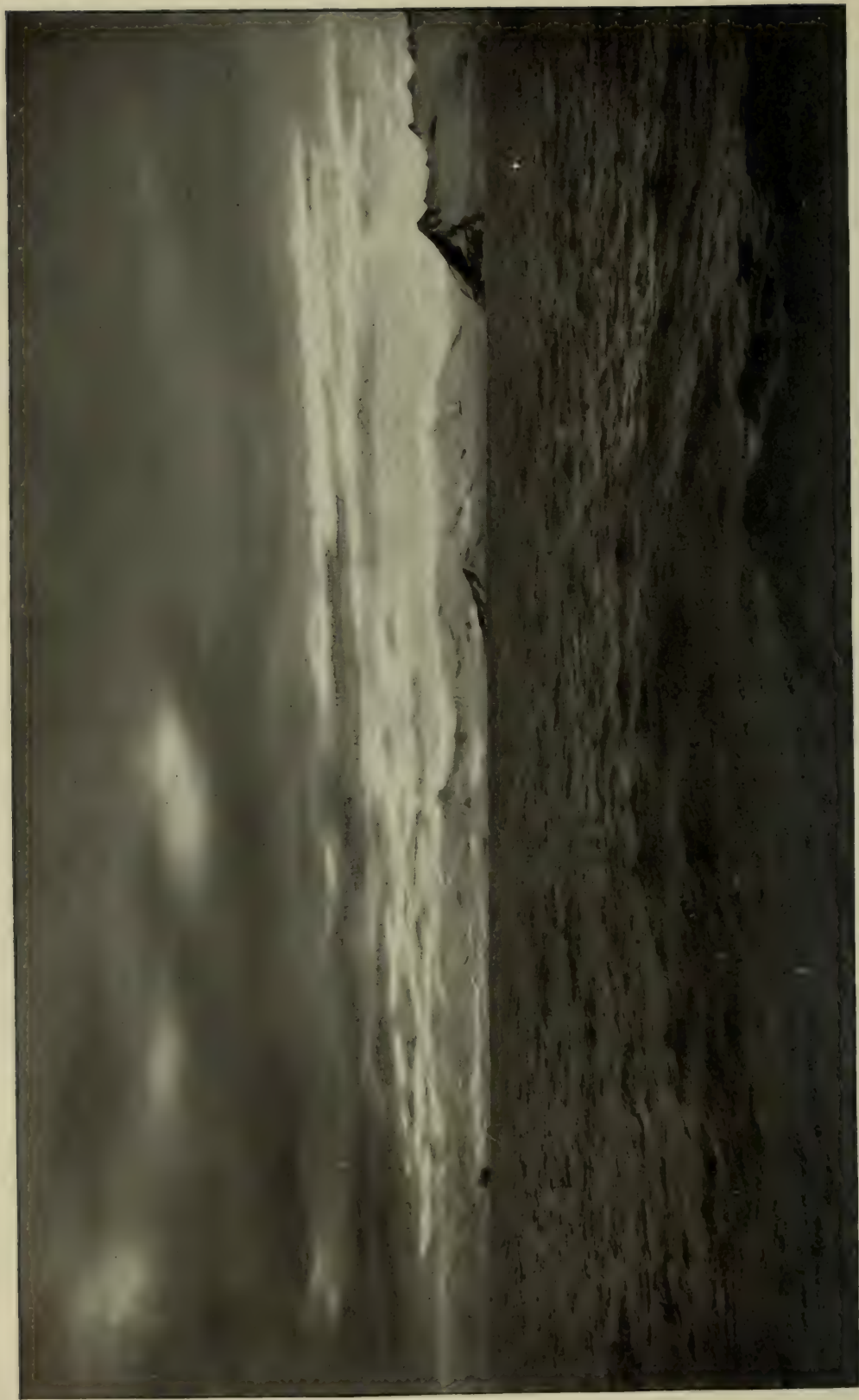
Before going south it was determined to examine a large bay to the eastward for a possible opening into the Weddell Sea (Brialmont Bay). The morning was foggy; but by noon the mist raised a little and we found ourselves off a bold, black cliff (Cape von Sterneck), with an altitude of about fifteen hundred feet, on a projecting point of land, with a few islands to the north and one to the south of it. This bluff forms the eastern headland to the entrance of what we later discovered was a strait opening into the Pacific, (Belgica Strait). Passing within a few miles of the shore we examined carefully the glacial wall which everywhere offered a check to our passage eastward. The interior of the land was covered with a cloud which did not lift during the day, but the coastal edge was distinctly visible, and offered us excellent opportunities for surveying.

During the night of the 24th we steamed leisurely across the channel and in the morning we found ourselves under a clear sky before a series of icy

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walls from 60 to 150 feet in height. From the sloping snows over these cliffs there was showered upon us a light which was perfectly dazzling to the eye. We selected here two points, where the ice had been partly melted, offering a footing and a place for making observations. The boat which took us ashore was loaded with men and instruments: Lecoins, with his nautical instruments; Danco, with his magnetic outfit; Racovitza, with guns and knives and what not, to take specimens of life; Arctowski, with his big hammer and dozens of bags for stones; Amundsen and the writer with snowshoes and camera, and the sailors with boat-hooks and guns to keep off and capture seals. If we had started out to make a month's siege on the new lands and life we could not have been better supplied. The cove in which we landed (Harry Island) was a slope of rounded ice-worn granite rocks, upon which Lecoins and Danco fixed their tripods. Racovitza turned up the stones along the shore where he found mysterious crawling things which he hailed with as much delight as if he had found nuggets of gold. Amundsen remained in the boat and sought to secure a few Weddell sea-leopards asleep on a pan of ice, while Arctowski and I mounted the inland ice to study its character.

The view which we obtained from the upper slopes of the land-ice was superb indeed. To the east was an island (Two Hummock Island) with two bare hummocks about two thousand five hundred feet high, and from these, expanding in every direction, was a bed of ice and snow many hundred feet deep.



Brialmont Bay.
Cape Murray.
Sunrise and Sunset, Together, over the Eastern Shore of Belgica Strait.

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Beyond this, just barely visible and about fifty miles from our position, was the feeble snowy outline of the great country (Dancoland) which offered us no hope for a passage eastward. Scattered about in the channel were numerous icebergs with petrels on their crests, as tenants. Near one of these rested the *Belgica* as easy and as stationary as if at anchor. We were on an island; except at the sea line, however, there was not the slightest indication of land. Everything was buried under a weight of snow and ice, about five hundred feet in thickness. There were dome-like elevations and some irregularities, but all was cold, white and lifeless. To the west of this island there was a canal with several arms offering excellent harbour facilities, and beyond, apparently within a stone's throw, though really five miles off, was Liege Island with Mount Brugmann, making the most glorious snowy landscape I ever saw.

Later in the day we followed this land northward and then proceeded to our first landing-place. It was a clear, silvery day, with only an occasional cloud rising out of the black waters of the north. The temperature was close to the freezing point, but the air was calm and dry. We were dressed in ordinary clothing, without overcoats, and when engaged in rowing, or climbing, our jackets were removed. Even lightly dressed, we perspired while trying to scale the cliffs of ice. The water was a joy to behold. It was like a mill-pond. Easy ripples deflected the sunbeams on the mirrored surface, and everywhere, on the surface and under it, could be seen the soft whiteness of the land-ice and the sav-

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age blackness of the *noonataks*. We kept the coast within five miles on our port side; at this distance it presented a scene such as one sees nowhere else in the world. There were in the foreground a few rocks too steep for snow to rest upon, black except on the north-eastern face, where a little moss added a flush of red and green; in the background everything was loaded down by continental ice. The inland ice, unlike that of Greenland, was irregular, and took the general outline of the mountain ridge under it. There was in view, for a distance of twenty miles, extending north-east and south-west, an unbroken series of mountains and ice-walls.

We spent the afternoon surveying this coast, and at 5 o'clock we were off the rounded peak (Mount Allo) which we first saw on the 23d. We then steamed again for the little island (Auguste) upon which we made our first debarkment. Here we rested under steam for the few hours of twilight, during the midnight hours, and on the 26th a number of sights were made for triangulation. The morning of the 27th was spent in a similar way. In the afternoon we steamed south to a number of small rocks (Gaston Islands), which we thought might be the islands laid down by Larsen on the east coast. Larsen claimed to have looked northward from his islands without seeing land, but we found it otherwise. The day was hazy, and, though the ice-wall of the coast was constantly visible, the interior of the country to both sides of us was obscured under clouds. A debarkment was made on one of the supposed Larsen Islands. They were three in number, of irregular shape and in size ;



View Eastward from Neumayer Channel.
Part of Wiencke Island. Sierre Du Fief in the Background.



Brooklyn Island.

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the largest was not more than a mile in its longest diameter. The two largest islands had, in the centre, cone-like peaks of bare rocks, from which an ice-mantle spread out to the shore line, as it does on all the antarctic islands. The smallest one upon which we landed was not more than a half mile wide and three quarters of a mile long. There was about it nothing to indicate land except a shelf of volcanic rocks upon which we placed the geologist with his hammer, while the boat withdrew to keep from being dashed to pieces on the rocks. The tide was low, and if Arctowski had been left there, or if our boat had been lost, we should have been forced to climb a vertical cliff of ice one hundred feet high, or take to the rising sea of ice-water, as did the seals and penguins. Neither prospect seemed agreeable, and the danger of falling ice from the cliffs was such that we soon returned to the ship. The haze of the morning thickened to a dense fog, which entirely blocked out our view of the main shore-lines on both sides. We steamed westerly in a line over which the channel seemed to open into a large body of water.

The prevailing query on board was, "Is this the Pacific or the Atlantic?"

The weather continuing foggy, we took advantage of the time to augment our water supply. Up to this time we had made eight debarkments, but found no place where fresh water could be taken. There were about us a large number of icebergs. One of these offered an even side as a dock, and to this we attempted to anchor the *Belgica* that we might se-

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cure ice from it, which could be melted and put into our tanks. The ship was taken to the side, while men with ice anchors and axes mounted to the berg. The men succeeded in placing the anchors, and also chopped a supply of ice; but the motion of the berg was such that it nearly stove in the ribs of the vessel in the effort to load. We were compelled to cast off and leave the unruly berg. A few days later, however, we found a small glacial stream from which we secured a good supply of water, which served us for several months.

Being still unwilling to advance into the unknown region before us while enshrouded in mist, we drew near a prominent mountain peak (Cape Anna), whose front was perpendicular and free of snow to the seashore. This peak was, as we learned on the following day, one of a number extending far into the south-west. We made a debarkment at its base. Here was life in profusion, as indeed it was on every rock where life could gain a footing. The noise from the birds which re-echoed from cliff to cliff was so deafening that our attempts at conversation were inaudible. The lower rocks were lined with snoring and grunting sea-leopards. Columns of vapour rose above the water followed by a hiss like that of a steam-engine, and a second later the blue back of a whale, with its long fin and ponderous tail, lashed the water into a foamy whirlpool. The great wall of land-ice, which rose to each side of the black cliff, gave us a shelf as a landing-place, and from this wall came frequent sounds like the explosion of a cannon, each followed by a great splash and a commotion in the

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water. With such reports, parts of the wall would constantly break away and explode into a million pieces, strewing the water with small fragments of ice, but not with icebergs. Above us rose a cliff to an altitude of about two thousand feet; out from this were projecting mantel-like rocks, which served as resting-places for cormorants and sea-gulls. Here the young ones, dressed in gray down, coaxed their mothers for food. We expected to see the little things drop from the narrow resting-places to be destroyed on our heads or on the rocks below, but such an accident rarely happened. Our greatest surprise here was the discovery of large quantities of moss and lichens, which gave the spot an appearance of life that to us, after having seen nothing but ice and black rocks for so many days, made it a true oasis.

From this point we were able to see in a splendid manner almost the entire length of the channel explored to this time; but we had not yet been able to make a running survey of the regions in our immediate vicinity. To get a better view it was decided to ascend to the interior of the land and scale one of the *noonataks*. In a bay (Buls Bay) to the westward the land offered an easy slope and to it we steamed on the following day. In our preparations for this ascent we made arrangements to camp on the inland ice for a week. A tent was taken, sleeping bags, and fur clothing were gotten out, and bags of provisions were packed, all of which was lashed on two small sledges. Volunteers were called for and those who responded were Arctowski, Danco, Amundsen, and the writer. Led by Gerlache we

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landed late on the afternoon of the 31st on a little point of land (Cape d'Ursel) with a northern or sunny face. We climbed the steep slopes for five hundred feet, and then camped for the night. The first night was one of stormy discomfort. A wind came out of the bed of a glacier above us, against which we could hardly stand. It took two men to hold up the tent, and the combined efforts of all hands to keep from having our effects scattered over the cliffs but a few yards away. On the 1st of February we made another effort and mounted a few miles into the interior, but fog and wind and crevasses made frequent halts necessary. The sledges were heavily loaded and were difficult to drag, and altogether the work of travelling and the discomfort of camping were such that the life was generally miserable. We succeeded, however, in mounting to the peak of a *noonatak*, with an altitude of about fifteen hundred feet, and from there Gerlache and Danco were able to get the observations necessary for the rough survey of our surroundings. The view before us was even more beautiful, if possible, than anything we had seen since our first entrance into this new white world. To the south-west there was an opening through a new land and into a new sea, which remained for us to explore later. To the north-east, descending into the white airy distance, were the two high banks of the new highway. Before us was a small island, shaped like a biscuit, and like everything antarctic, it was covered with ice to the water's edge. Around this berg-like island were a number of icebergs,



Lemaire Channel.

Wandel Island.



Cape Cloos.

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stranded on submerged rocks, and these, by occasional mysterious explosions, sent up the noise and the commotion of a thousand cannons. The opposite shore here retreated, making two large bays. In these bays were a number of islands, beyond which we could see clearly a narrow canal. The land which spread out under the southern and eastern skies offered no promise of a passage eastward; it had a series of black cliffs parallel to the coast about five miles beyond the edge of the sea, and beyond these the white outline of the land rose into the clouds.

After a stay of seven days, which was our first camping experience in the antarctic, and the first in the history of south polar exploration, we gladly betook ourselves to the good old bark, which had returned from a cruise southward. During our absence the *Belgica*, under Lecointe's direction, had been on an exploring cruise to the south. The effort was brilliantly successful, for Lecointe reported the discovery of several islands, upon one of which Racovitza had discovered the metropolis of Belgica Strait, a city of forty thousand penguins, and beyond these islands there was what promised to be an unobstructed highway into the Pacific. To examine this and the extension of the waters before us was our next mission; but Lecointe was not yet satisfied that the wide bay opposite our encampment (Wilhelmina Bay), did not extend through Danco-land to the Atlantic. During the night of February 6th we steamed across the Strait, and early on the following morning we were off Cape Murray. Keep-

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ing close to the shores we followed the great wall of ice which lined the shore-line from Cape Murray to Cape Reclus. At noon we rounded Cape Reclus, a long tongue of land-ice with a saddle-shaped mountain in the center, and entered a canal-like body of water, with the high ice-walls of Dancoland on the east and the shore lines of Nansen and Brooklyn Islands on the west. This was certainly a fairy-like scene; but a heavy fog settled down over us, blocking out, for a time, the savage peaks which pierced the heavy spread of snow and reared their towering heights far into the dull skies. In this fog the water had the colour and the glimmer of polished silver, while the walls of ice rising from the shore-lines stood out in great lines of ultramarine blue. We continued our search along the mainland, and in the evening we found ourselves opposite Sophie Rocks, which we had seen from the other side. The body of water through which we sailed on this day has been given the name "Chenal de la Plata," in honour of the capital of the Argentine Republic.

A scene which I photographed at midnight on February 7th pictures this land in a faithful manner. The sun was just under the land-ice, painting the sky in orange and the land in gold, while gliding northward behind a great crested peak 4,000 feet in height. To each side of this black peak were rugged edges of stratified rocks which had once been under the sea, but were now raised to an elevation of two thousand feet, and buried under a sheet of ice of more than a thousand feet in thickness.

On the morning of February 8th we had com-



Ascending Icy Mountains.



An Encampment.

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pleted a rough survey of the mainland eastward, and a running survey of the eastern banks of the Liege and Brabant Islands. We did not follow the channels leading northward and westward, nor did we prolong our examination of the lands in that direction beyond the banks of Belgica Strait. We steamed around Cape Anna, and then headed for a remarkable cliff, at the base of which we made our fourteenth debarkment. The day was a delight. The sun showered its full wealth of rays on the sloping snows with such force that the reflected beams made the air and the water perfectly dazzling. It was a photographic day. As the ship steamed rapidly along, spreading out one panorama after another of a new world, the noise of the camera was as regular and successive as the tap of a stock ticker. Not less than three hundred photographs were taken on this day. Surely, in the hundred miles of land which we discovered on this memorable day there were no landmarks which were not on our plates. Everybody was on deck with pencil and paper, some making nautical and geographical notes, others geological and topographical notes, and all recording the strange other-world scenic effects. Even the sailors, the cabin-boy, and the cooks were out with paper and note-books, taking long looks and then bending over their paper.

The landscape was not materially different from what it had been along the scores of miles which we had discovered during the days previous, but the clearness of the atmosphere made it possible to see to the limit of every point of the horizon. There

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were on this day many notable sights, but I shall mention only two. Early in the afternoon we saw on the northern side of the channel a great red cliff of granite. Its bare face was only about one thousand feet high, but, with its snow-covered base and its icy crest, it stood up boldly to an altitude of three thousand feet against the clouds, which now came from the south-west. A little farther south the channel was divided into two arms by an island, with a bold round rock as a headland (Cape Eivind Astrup). We took the western arm. This passage was not more than from two to five miles in width, and its length was about forty miles. We entered it at four o'clock, and steamed for six hours in a silvery fjord, whose walls of ice and rock rose over us to a height of from three to four thousand feet. At ten o'clock we saw the black sky of the Pacific and the terminating banks of the newly discovered Strait.

Here, within sight of the Pacific, was a large bay (Borgen Bay) surrounded by mountains (Osterrieth Mountains) fully three thousand feet high and covered with snow to their summits. In this bay we rested for the night.

The morning of the 9th was as beautiful as the day previous, and under the warm rays of the sun we made two debarkments to fix the position of the landmarks of the southern opening of the new Strait, and to make the usual scientific collections and observations. The time from the 9th to the 12th was spent in exploring this region. The country was somewhat higher than any we had seen farther northward. Glacial discharge had a greater tend-

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ency to be sent out by tongues into the sea. The northern cape (Cape Lancaster) has a long tongue of ice rising with an easy slope to a single mountain of moderate height. This agrees well in position with the Mount William of Biscoe. The southern cape (Cape Reynard) is made prominent by a number of needle-like peaks, which are too steep to offer a resting-place for snow. Between these two prominent capes is a large island (Wiencke Island), which has running through its center a ridge of high peaks (Sierra Du Fief), nearly free of snow. The northern point of Wiencke Island is a black bluff crowned with an even sheet of ice which breaks off into the water to both sides of the cape. This point has been named in honor of the faithful companion of Lieutenant Peary, the friend of Mr. Amundsen and myself, Eivind Astrup (now deceased). The southern cape (Cape Errera) is remarkable, because upon it is a unique pyramidal peak. Just beyond the southern termination of Wiencke Island there are a number of small ice-capped islands (Wauwermans Islands).

In the past three weeks we have been remarkably successful in discovering new regions. Without encountering any serious difficulty we have passed through a new highway from Bransfield Strait, two hundred miles south-westerly, through an unknown land to the Pacific, which has been given the name "Detroit de la Belgica." This highway is perfectly free, in summer, for ordinary navigation. The scores of new islands which dot the virgin waters are inhabited by countless millions of penguins and cor-

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morants, while great numbers of seals are in evidence on every accessible rock or ledge of ice. In the waters are large numbers of finback whales which, with the seals, will in the near future offer a new industry. To the west of Belgica Strait there are four large mountainous islands (Liege, Brabant, Grand, and Anvers Islands). These islands are probably guarded seaward by a great number of small islands. Over this group we have written the American name, Palmer Archipelago, in justice to the young Yankee sealer, Nathaniel Palmer, who first of all men saw the outer line of this still unknown coast. The various islands, mountains, capes, bays, and headlands have been named in honour of Belgian friends of the expedition. We have not, however, forgotten prominent outside workers, as is clearly shown by Neumayer Channel and Nansen Island. The honor of bestowing some names fell to the lot of each officer. Two islands, which it has been my privilege to name, are called Brooklyn and Van Wyck Islands; Brooklyn, in honour of the city of my home, and Van Wyck, in honour of the first Mayor of Greater New York.

To the east of Belgica Strait the shore-line is unbroken. It has many deep indentations, but there is no passage into the Atlantic. A continuous wall of ice, from fifty to one hundred feet high, fronts the coast everywhere. This land is from two thousand to four thousand feet high, with mountains farther inland perhaps six thousand feet in altitude. Every valley and every surface which is not perpendicular is buried by a sheet of never-melting ice. We were

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not able to follow the coast of this country far enough south to determine the interesting question whether it is continuous with Grahamland or not. This land has received the name Terre de Danco, in memory of our late faithful companion, Lieutenant Emile Danco.

CHAPTER XI

FROM DANCOLAND TO ALEXANDER ISLANDS

AT about eight o'clock in the evening of the twelfth we select what seems to be a comfortable resting-place for the night. Owing to the great depth of water we cannot anchor; hence, in accordance with our previous habits, a little steam is kept up for an emergency movement, and the *Belgica* is allowed to drift with the winds and the currents during the hours of rest. No one ever knew except the officers on the watch how many narrow escapes we had in our silent hours of slumber. Quietly but quickly the bark moves about, now in danger of being thrown against an iceberg; now being propelled by some mysterious force in a direct line for a rocky island, or the huge blue ice-wall of the mainland. Danger and destruction are always within sight. They are over the gunwale on every side. And then there is always the hazard of submerged reefs upon which we might easily and unexpectedly ride to a rapid end. Hair's-breadth escapes have been on hand daily, until now we have become hardened to the real dangers which are constantly before us. But up to

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the present nothing has happened, and this freedom from casualties is due to the persistent watchfulness, the painstaking care, and the praiseworthy faithfulness of the officers and men on watch.

The night is of special interest to me. There is something about the air, the water, the ice, and the land, which fixes my attention and makes sleep impossible. There is a glitter in the sea, a sparkle on the ice, and a stillness in the atmosphere, which fascinates the soul but overpowers the mind. There is a solitude and restfulness about the whole scene which can only be felt; it cannot be described. Here, to the east, the face of the mysterious land is clothed by the successive sheets of snows of the sleeping years of countless silent centuries. About us are scores of icebergs, huge table-topped, pyramidal, and castle-like masses, fragments of this same unknown blanket of accumulated snows which clothes every aspect of antarctic land.

Out of the unfathomed blackness of the ocean to the west rise a series of heavy mouse-coloured clouds, with their cargoes of vapour, which sail over us in a regular train to deposit their snows on the unscaled heights of the overland sea of ice eastward; under the stream of vapour floating landward there is an occasional puff of icy wind rolling down the stupendous white heights of Grahamland, which suddenly chills the air about us and renders it incapable of suspending its charge of humidity. As a result, there is either an occasional shower of snow or a bank of fog which, for a time, veils the electric splendour of our chilly fairyland.

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Although the sky is cloudy and dull, and the sun is below the horizon, there is a mystic light thrown against the masts and every projecting object, which is, indeed, strangely puzzling. The sun is sliding eastward under the southern sky, and over it, close to the horizon, hangs a narrow band of lemon which remains from sunset to sunrise. This zone of lemon is the only suggestion of colour in the heavens, and, curiously enough, the light does not seem to come from the regions over the sun but from the east. There is a haze over the land which is luminous throughout the short night. The ice-blink, here, from the snowy mountains far beyond the horizon, is reflected from slope to slope and then into the land mist, giving it a curious glow which at first seems inexplicable. This vapour changes in colour from sapphire during the evening, to turquoise at midnight, and again to violet at dawn. These hues, with their indescribable gradations, are spread over the whites and blacks of the waters, and the snow and the rocks of the land. It all seems like an artist's dream.

This morning, the thirteenth, opened with a brilliant rosy sunburst over the icy alabaster walls of Grahamland: but this charm soon gave way to a black mist which quickly suppressed the glory in which we had rested during the few hours of midnight twilight. We are steaming slowly westward, but the obscurity and the threatening character of the weather prevents material progress. There is a light breeze from the north-east, and a heavy swell from the north-west. The temperature remains



Cape Eivind Astrup — Northern Point of Wiencke Island.

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steadily at $08^{\circ}\text{C}.$ ($33.44^{\circ}\text{F}.$). We encounter small ice loosely strewn in the waters in considerable quantities as we advance, but owing to its diminutive size it does not offer any difficulties to our progress. This ice differs greatly from any which I have seen floating upon the sea either before or since. There is no ice of the same character in the arctic. It is a form seen only along the outer edges of the antarctic lands. There are three varieties of ice which are held here close to the land by the huge swell of the South Pacific. The kind in greatest abundance, giving the entire collection an appearance different from all other packs of ice, is mostly from two to five feet in diameter, with irregular glassy angles. It consists of fragments of fresh-water ice from the glacial wall which everywhere fronts the antarctic lands. Some, too, are the product of iceberg disruption. Mixed with these hard, blue crystalline masses, are some spongy pieces of salt-water ice, which are the product of pan-ice disruption. Everywhere the white spires and table-tops of the colossal icebergs are seen to rise over the restless icy water. At about three o'clock the sun burst through the dark curtain of mist which hung over us, and the dull, ice-strewn sea, which had been dreary and cheerless and full of hidden dangers, became a most charming array of glittering brightness.

This is our first view of any considerable quantity of the sea-ice of the antarctic, and as it rises and falls on the breast of the new polar ocean it offers a dazzling glow, and a life which fill us with a healthful enthusiasm. Steam is now quickly in-

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creased, the sails are set, and the officers take their positions to push the *Belgica* southward, farther into the unknown. The scientific men are scattered about, some in the masts, some on the bridge, and others on the poop; all looking anxiously for surprises in the new life and scenes about us. Even the sailors cannot resist the temptation to stand still and drink, with awe-inspiring amazement, the strange wine of action which hangs over the mysterious whiteness of the new world of ice.

Although we feel that we are on the threshold of more great discoveries, and although, for some unexplained reason, we are all in a fever-heat of excitement, quite like a prize-fighter on the eve of a great battle, calmly and coolly considered there is nothing very wonderful in our immediate surroundings. The weather is quiet but unsettled. A heavy sea rolls in under the pack-ice through which we plough. To the west there is a black sky and under it, just on the horizon, is the dark line of an open sea with the marbled peaks of bergs silhouetted against the black sheen of the heavens. Far to the eastward, about seventy miles off, is the rough outline of the great white land which we have followed for the past three weeks. From the crow's-nest at the masthead we can see fifty miles of this strange country. It begins in the north-east and fades away in the airy distance of the south-west. Over the port-bow there is a fjord-like break through the land which seems to extend eastward as far as our eyes can reach. This may be another canal like Belgica Strait. If so, its position corresponds fairly well with Bismark Strait, which



Cape Renard, Dancoland.

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was vaguely seen by the German sealer, Dallman. The opening, however, of this prospective strait is choked with heavy ice and, though we are eager to push landward and examine the coast carefully, the drift-ice forces us farther and farther away from the shore-line. In our over-anxious efforts to keep the coast in sight we have pushed into an area of ice which, for a time, shatters our new hopes.

This area is covered by ice such as we have passed through all day. As the sea rolls under, it seems a quivering mass of small fragments. There is nothing about it to suggest its ensnaring powers. We steam into a tongue which spreads out seaward. Over this there is a smoky sky indicating that behind this ice, and immediately before us, there is an open sea. Soon after we enter the ice, an on-shore wind and swell force the fragments together and bring a number of icebergs against the pack edge. We try with steam and sails to gain our release from the sudden embrace, but our efforts will be of no avail until the wind changes and the icy grip loosens. Our surroundings are wildly picturesque. To the east of us are the high peaks and limitless glaciers of Grahamland. The country is visible for only short periods and in patches, for a high fog hangs constantly over the land, leaving only an opening here and there. To the west the sky is fairly clear. A dark smoky zone near the horizon indicates the limits of the ice and the open sea beyond. Hundreds of icebergs are on the horizon. These are of a size and type quite similar to those of the arctic sea. The entire mass—icebergs, sea-ice, and the ship—rises

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and falls with the gigantic heave of this South Pacific, and for a time it seems as though we are to be carried with the moving drift against one of a number of small islands. But a change in the direction of the wind promises to so separate the ice that we shall soon be able to force our way out into the open sea westward.

February 14. — We are again showered by a cold drizzling fog. We have reached clear water and are pushing slowly southward. During the day the fog rose occasionally, giving us a peep of the black peaks and the snowy, glacial plains and slopes of Grahamland; but everywhere the drift-ice is packed against the land in such a manner as to offer no hope for a safe approach. Late in the day we came to a point where the drift-ice suddenly terminated, and left the land accessible. The officers and men worked hard all through last night, in their efforts to extricate the bark, and everybody is now thoroughly exhausted. We sought the land to find some sort of a haven where the vessel might rest during the night, while the men try to gain a few hours' sleep. But our experiences in this venture were not such as to be conducive to slumber; indeed, it proved one of the most anxious and restless nights which had fallen to our lot while in this region. During the early part of the evening we felt particularly pleased at the prospect of a quiet night. Everything seems to promise this. The weather is clearing; the temperature has fallen a degree or two; the sky exhibits a bit of blue here and there; and even the ever stormy sea eases its

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merciless pitches. The *Belgica* glides along easily and restfully as though she expected the needed period of rest, while the petrels and gulls hover over us as if to pilot us to a safe retreat. At six o'clock we are within a few miles of a chain of low islands. They are small masses, mostly about a quarter of a mile in their greatest diameter. Some are completely buried by a cap of ice sixty feet thick, but others are bare. The rocks are mostly granite, smoothly polished by the combined action of the sea and the ice. With our glasses we can see small patches of green and brown moss in sheltered nooks; the snows along the shore are tinged red from penguin habitation, and green with sea algæ. Scattered all about these islands are a great number of large icebergs. The chain of islands and the berg certainly offer us a safe and promising shelter.

After steaming into a canal beyond which we expected to lay-to we found ourselves suddenly and unexpectedly surrounded by white crests, under which appeared a circle of submerged rocks. So complete was this hidden circle of danger about us that we could not, for a long time, find a spot where the distance between two rocks was sufficient to permit an escape. We dropped a lead fifty fathoms, several times, but found no bottom. A current rushed over the reefs and with our full force we could barely make headway against it. In this position, with the swash of the breaking waters coming to us out of the darkness, with the penguins and the gulls screaming premonitions of danger, we struggled

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against a current which seemed set to effect our destruction on one of the reefs behind us. The firemen forced the steam, and the engineer urged on the engines as he had never done before. Little by little we gained on the force of the current and headed for an iceberg which was about one hundred feet high. We argued that if there was sufficient water to strand this berg it would be enough for us; but the passage to the berg was not more than one hundred feet wide, and if there were or were not dangerous shallows there we had no means of determining. The sea was too heavy to send a boat in advance to make a sounding; and because of the rocky and uneven character of the sea bottom, soundings from on board gave us little warning. We must steam on and take our chances.

These were anxious moments. We expected momentarily to feel a sudden jar and a sudden arrest of our progress. We had had such an experience twice before, and now expected a third. Amundsen was in the foremast; Gerlache and Lecointe were on the bridge; Arctowski and I were on the bowsprit. We were all looking for and expecting trouble, but we passed beyond the angry crests of the reefs and out into deeper waters safely. The sense of relief and rest which came over us at this time was indeed a godsend.

Selecting a position in the lee of these islands, and close to a large grounded iceberg, the bark was brought up to the wind and kept under easy steam. It was difficult to keep from drifting onto the islands or the bergs. At midnight the wind came down



Stratified Tabular Iceberg, off Cape Rasmussen, to the lee of which the *Belgica* rested during the night of Feb. 12.



Iceberg in Belgica Strait with a Great Tunnel through it.

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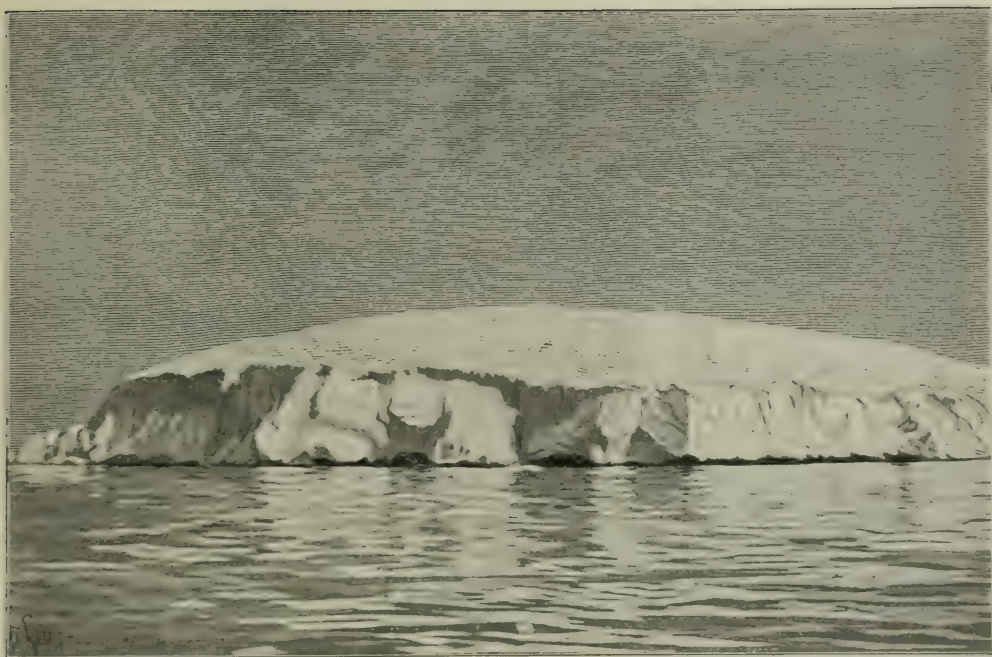
from the glacial gullies and brushed the masts with hellish force, sending us pitching and tossing over the disturbed sea in a manner which unbalanced the equilibrium of the stomachs of even the oldest sailors. Now we rocked within a few yards of the death-dealing wall of a berg, and again we rolled uncomfortably near the phosphorescent breakers of a submerged mountain. Material for our destruction was always close at hand, and we went out often to see it. Sleep, rest, and quietude were far from us on this memorable night of the fourteenth.

Early in the morning of the fifteenth we withdrew from our nightmare of terrors and took to the more stormy and less dangerous waters westward. There had been some snow, and rain, and sleet during the night. The ropes were coated with ice, the masts incased in a glassy plating, and the decks as slippery as ice could make them. The sea struck us heavily under the starboard poop and spread a spray of water over the quarter-deck. We took the wind from the north-east and set a course south-south-west. The wind being free it became necessary to manipulate the sails and hustle about on deck. With the vessel madly rocking, the ropes incased in ice, and the floor glassy and glittering, the difficulty of this work can be more easily imagined than written. In one corner there a sailor on hands and knees was trying to keep from being used as a baseball; in another, an officer was making the air sulphureous because the ice on the ropes has cut his hand. Just then the cook came along, and finding it more easy to stand on his head than on his feet, the

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soup was spread over the ice as a lubricant; and then some one uttered complaints in easy *Belgica* language because there would be no soup for his dinner. Altogether this was a day of misery, and it was followed by many of a like nature.

Nearly everybody was seasick to-day; at least, everybody would be if they admitted the truth. No one feels quite comfortable; we are all inexpressibly tired and sleepy and uncomfortable at the pit of the stomach, but nobody admits being a worshipper of Neptune. One is bilious, another has eaten some "embalmed beef," some have headaches, others rheumatism. All the symptoms indicate ordinary seasickness, the effects of the sudden throws upon the brisk, choppy sea. I have often noticed this glum feeling come over an entire ship's company after being in ice or sheltered waters for any considerable time, as we have been. We pride ourselves, however, as being weather-beaten sailors, and having passed the nauseating storms of Cape Horn we are not going to admit *mal' de mer*, even if we did feed the fish several times during the course of a meal.



One of the Wauwermans Islands.



Sophie Rocks, Dancoland.

CHAPTER XII

ACROSS THE ANTARCTIC CIRCLE—FIRST EFFORTS TO PENETRATE THE PACK



Snowy Petrel,
(*Pagodroma nivea*).

On the evening of the fifteenth we had sunk the land and the drift-ice under the north-eastern horizon. There remains, in that direction, an ice-blink, a

bright, cream-colored zone on the sky, which indicates that ice and land is not far off. Icebergs are about us in great numbers, but they are all small, hard, rounded masses, showing the effect of stormy seas. None are over one hundred feet high, and all have a polished surface with huge blue cavities, into which the sea rushes with a cannon-like roar. Giant petrels, cape pigeons, albatrosses and gulls hover about the bark in the air, but in the water we see no life. The night promises to be clear, with a continued fair wind sending us along at the rate of six knots without steam. We are all on deck watching the good old ship plough her way merrily through the virgin antarctic seas, feeling proud of her sterling qualities,

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and of her sailing capacity, when the Captain suddenly springs into an ecstasy. He acts like a boy with a new toy. We look about for the reason for all the commotion, and he points to the heavens; there, through a break in the low stratus clouds, gleams a star. It is a lonely speck in a narrow strip of blue, but it is the first star which we have seen while along the edge of the south polar lands.

If our dead reckoning is correct we shall cross the antarctic circle to-night, but we have had no opportunity for several days to fix our position. The intermittent fogs and heavy clouds which hang over us constantly have deprived us of the necessary glimpses of the sun, the moon, and the stars, with which to make the nautical calculations. At present our positions by account are only guesses at an actual location because of our absolute ignorance of the currents. During the day and the preceding night we passed great numbers of icebergs, but they were all of the sea-washed and storm-rasped type; irregular in shape, few over a hundred feet high, and all of a dull gray blue colour. The bergs here seem to be fragments of larger tabular masses. Early in the evening a yellow cloud-like figure rose out of the south-east. This, on a closer approach, proved to be a continuation of the mainland. There were tall angular peaks which stood out boldly against the ice-blink thrown upon the vapour which hangs over the land. Between these black peaks were blue valleys filled with glaciers, pouring their frozen streams down the slopes and out into the sea.

At eight o'clock on the morning of the sixteenth

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we came on deck to gain the first view of the new panorama which the lifting fogs had unveiled. The land here, behind a very bold black headland marking the bluff point of a projecting cape, trends suddenly eastward and sinks under the horizon. The north-western side of this cape is remarkable for its great tongue of ice spreading out smoothly from a snow-covered ridge far interior, and breaking off in an even uninterrupted wall of ice at the seashore. The southern shore has also a great ice-wall, but this wall is interrupted by several black, rocky cliffs which separate the land-ice into numerous glacial streams. Beyond the black headland there are two sharp peaks, about four thousand feet high, and to each side of these are a few dome-like mountains of a lesser height. About ten miles beyond this ridge there is a chain of white peaks, with a general height of perhaps six thousand feet, running parallel to the eastward trend of the coast. Far to the south, still fifty or sixty miles off, we saw a great mass of high land which later proved to be a group of islands. Between the headland eastward, upon which our eyes first landed, and the great cliffs to the south, there is a break in the land which may be a bay or a strait. It is filled with heavy sea-ice and studded with countless icebergs, making an examination of the continuation of the coast impossible. We were compelled to set a course southward, leaving open the question as to whether the coast of Grahamland ends here or extends farther poleward.

Leaving this land behind us we steamed southward during the day, pressing as closely to the land in

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that direction as the pack-ice, which was held close to the shore, would permit. We decided, at this time, that the land before us was Alexanderland, and behind us, probably, that which is charted as Adelaide Island; but there is nothing about this latter land, as we view it over the stern, which indicates that it is an island. If an island, which Lecoigne doubts, it must be a very large one, with the eastern termination beyond our horizon. On the whole, it seems to us like a very large country, ridged by at least two high mountain chains, which are covered with ice to their peaks. We have formed the impression that it is a part of the mainland, and conclude that a strait probably separates Grahamland from the farther antarctic. But this is merely an impression; the facts are that the land, though agreeing in position with the assigned location of Adelaide Island, does not bear any resemblance to the discoverer's meagre description. As to the land before us, there seems to be no doubt among the officers but that it is the country charted Alexander I. Land, by the Russian explorer, Bellingshausen, seventy-six years ago. He saw it only from a great distance and it has not been seen by human eyes before or since. Now the *Belgica* is heading for it; but there is so much heavy pack-ice, which appears to embrace the shores, that we do not entertain any hopes of effecting a landing.

At noon our latitude was $67^{\circ} 58'$ south, the longitude, $69^{\circ} 53'$ west of Greenwich. We hauled a little westward of the outer drift of the pack, and Alexanderland rose up over our port bow still forty

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or fifty miles away. There are scattered in the waters westward, and in the pack eastward, forty-four icebergs of moderate size. About half of these are tabular in form; the other half are of the pinnaled and sea-washed, or weather-worn variety. A few small black-billed penguins are in the water, darting over the surface and again into the deep, with electric swiftness. Close to the pack-ice, there rises from the black surface of the sea, a number of columns of vapour-like jets. Through our glasses we see under these the black backs of whales with large dorsal fins, and occasionally a ponderous tail whips the water into a foamy whirlpool. On some of the pans of ice are seals basking in the sun, and over the ship, apparently touching the masts and the ropes as the bark rocks to and fro, are giant petrels, Cape pigeons, gulls, white, brown, and blue petrels, all pointing their bills and stretching their necks to examine, perhaps for the first time, human beings and their crafts.

There is a dreamy stillness in the air, in spite of the frequent stirs of wild life, and a charming touch of colour to the sea, the ice, and the land, though the sky is dull, gray, and gloomy. At first glance all seems white and black, and we are impressed with the weight of the awful snowy solitude into which we are entering. A sense of chilly loneliness is more and more forced upon us by the passing panorama of snow, and ice, and deserted rocks. But, critically considered, after the first pangs of desolation have passed, there are a few of us who find some cheer and colour in the harmony of the

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perennial chilliness before us. This morning there was a break in the clouds, and through this came a flood of yellow light which made the bergs and the icy cliffs of Alexanderland stand out like walls of gold. Shortly after noon a pale blue was thrown over the white glitter of the pack, which increased the high lights, darkened the shadows, and made the moving mass of whiteness, as it rose and fell with the giant wave of the sea, a thing of gladness.

At four o'clock in the afternoon we had made a rough outline of the new land before us. It proved to be a group of islands (Alexander Islands) about twenty-five miles long and from ten to fifteen miles wide. There is one large central island, about eighteen miles long, with a high ridge of mountains running approximately from east to west. In this ridge there are three peaks not less than four thousand, five hundred feet in altitude. These are quite pyramidal in form and are covered with snow to their summits, with only an occasional bare, perpendicular rock. This ridge of mountains tapers gradually towards the west and terminates abruptly in the east. Running parallel to this central ridge, about four miles southward, there is a lesser chain of mountains about two thousand feet high, whose sides sink almost perpendicularly into the sea. There is also a similar ridge to the southward. The two valleys between these three ridges of mountains are filled with great sheets of glacial ice. We had a splendid view of these glaciers as we passed about twenty miles off the western end of the island. The northern valley was rough, much crevassed, and generally



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Midnight At Midsummer Over The Antarctic Mainland

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irregular, extending its tongue out over the sea for several miles. The valley south of the central ridge appeared like a great plain with easy slopes toward the sea, where the frozen mass seemed to project over the waters for a short distance. Around this one large island were a number of small islands, angular rocky masses, mostly covered with caps of glacial ice. These, from a greater distance, appeared to be a part of the main central land mass. The vast number of icebergs to the eastward of the land gave it, also, from a greater distance, the appearance of being connected with some larger land eastward; but from our various positions we were able to make out distinctly that the islands are a separate group with no other land eastward within sight. Our positions northward in the morning and southward during the night, proved this. We saw some signs of land to the south during the afternoon, but these vanished later. It was evidently a mirage.

We lost sight of the Alexander Islands at about ten o'clock last night, when it became too dark to see more than a few miles. During the night we steamed slowly over a south-westerly course close to the edge of the pack. At 6 a. m. (February 17) the fires were covered and the sails braced to a fair wind, sending us along, south-westerly, at the rate of about four knots. There was some rain and snow during the night, which lined the decks, covered the ropes, and sheeted the sails with ice. So thoroughly were the sails incased that we were unable to set the patent topsails. We hammered and pounded the

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sails and then we pulled and lugged at the ropes, but our efforts were in vain. The steam-winch was brought to our aid, but it, too, failed to bring down the icy sails. At eight o'clock, when I came on deck, there was no land or ice in sight. (We saw no more land for thirteen months.)

An hour later we passed along the outer fringe of small fragments of drift ice. The weather changed every few minutes. Alternately we had rain, and sleet, and fog, and snow. Our speed was increasing and the wind came in strong puffs. We had seen very few bergs in the forenoon, but the horizon was constantly hazed by thick weather, so we must have passed many without being able to see them. Just before noon, while trying to walk over the slippery decks, my attention was suddenly directed to a dark spot in the fog over our port bow. I watched this for a second or two, for the spot grew curiously lighter as we went on. Everything was stiff, and dark, and dull. The look-out on the capstan threw his arm easily, but anxiously, on the anchor and leaned over to fix his eye on the same object, but he gave no signal, and I said nothing, for there didn't seem to be anything tangible to report. The Captain now walked from the chart table to the port-side of the bridge; just as he caught sight of the curious object it brightened with a blink and a fraction of a second later a great wall of ice, towering far above the masts, stood before us. "Hard-a-starboard," shouted the Captain, with such abruptness and such force that a quiver went deep into the heart of everyone on deck; a few moments later



The *Belgica* pressing Southward through the Drift-ice.



Iceberg off Cape Tuxen.

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we grazed the marble-like cliff of a huge iceberg, gliding by so closely that we nearly scraped its knife-like edges.

During the afternoon we sailed westerly, keeping the streams of drift-ice within sight. There were fewer icebergs as we advanced, but it continued foggy, with alternate squalls of rain and snow, which prevented our seeing to any long distance. The ice which we have passed within the past few days, and the pack to the southward, are not, at any place, formidable except in the choked channels, Bismarck Inlet, and the inlet north of Alexanderland. If we had awaited an easterly wind, which is the prevailing wind of summer, no doubt we might have forced a way southward along the coast of Grahamland. The season for antarctic navigation, however, is already past, and if we are to make a point far south this year, which the Commandant desires, we must push on with all force.

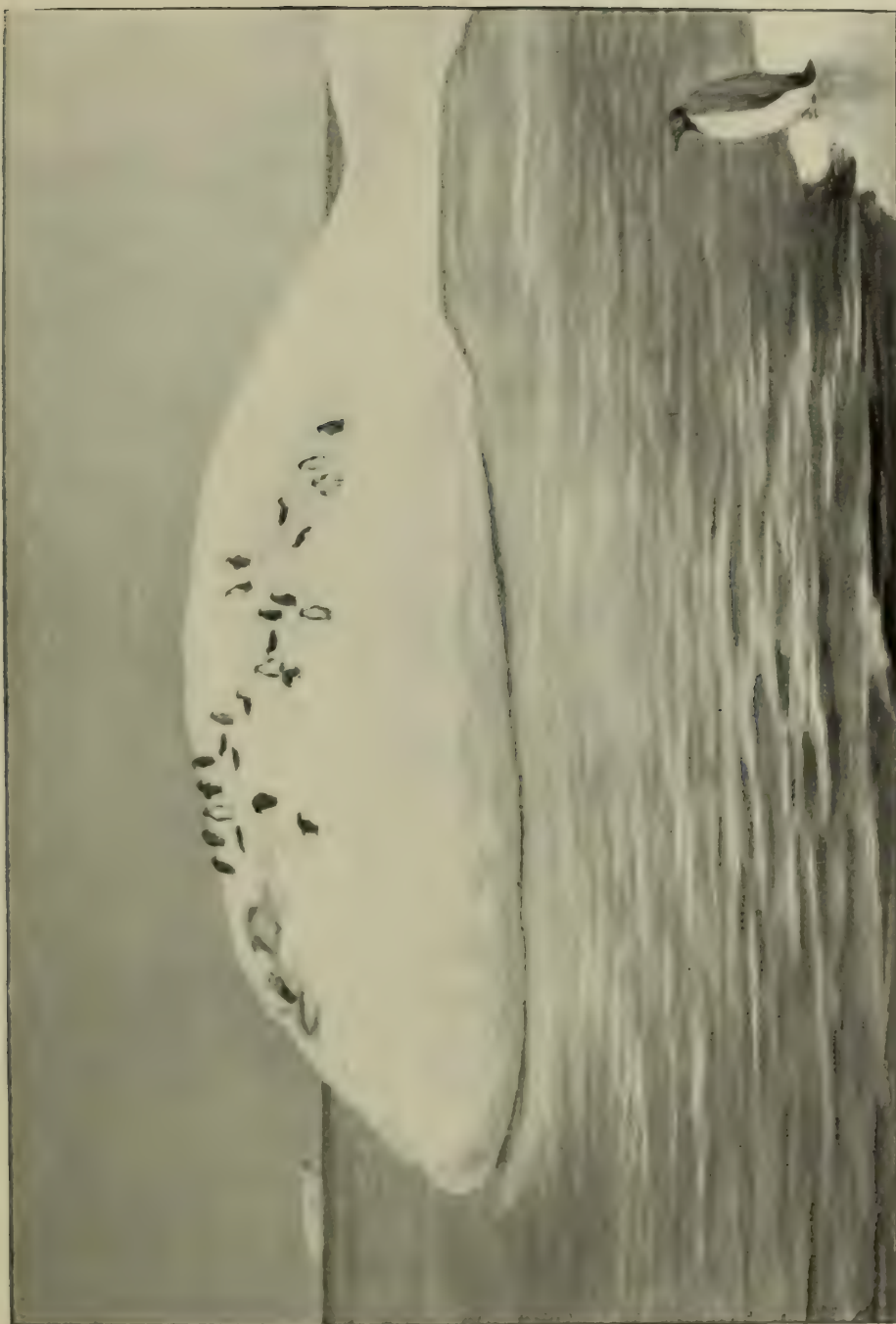
Early in the evening the prow was turned southward. With sails and steam the good ship was rushed through the light streams of drift-ice. The sea rolled under her in great inky mountains and the ice, in response to the wave, gave off a noise like the crackle of a silk garment. At midnight we came to a region where the sea was closely covered with ice, but the pieces were still small and separated by bands of water covered with brash.

6 a. m. February 18. Those of us not directly connected with the navigation of the bark, and the men off watch, slept very little last night; the noise of the larger pans, as they struck the ship, and

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the grating and rasping of the smaller fragments, as the *Belgica* was forced through the ice, was such that sleep was impossible. We were all anxious and uneasy. There was little wind, but it was dark and foggy, and icebergs were everywhere to be expected. Mentally another berg collision was constantly before us and every unusual thump suggested a calamity. As the purple gray of dawn illuminated the horizon eastward, our hearts beat more easily, and our minds were more at rest, though the new scene which now lay before us was the most hopeless icy-desolation which, to the present, it had been our lot to see.

All about us the ice was very closely packed. There was a seemingly endless sea of ice, waving on the swell of the great restless waters under us. It was the first really good view which we had had of the characteristic ice, which covers the limitless expanse of this circum-polar ocean. Farther northward the true sea-ice was so much melted and weather-worn, and so much mixed with small angular fragments of icebergs and other land-ice, that the pack was a conglomerate mass entirely different from the true pack-ice. Now, as the sun rose and the mist dissolved, we saw pans of ice of an average diameter of one hundred feet, with a thickness of five feet, whose surfaces were raised here and there, by old wind-rasped hummocks or miniature mountains, from one to two yards high. Between these pans there were zones of water covered with closely packed pulverised ice, in which there were some pieces a few feet in diameter. In our efforts to push southward we selected these lanes between the larger pans, but the fine ice



Penguins on a Sea-worn Iceberg Resembling a Whale.

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so effectually stopped our progress that even by using the full power of the engines we could not make more than two miles in six hours. A long and continuous swell of the Pacific was responsible for the steady pressure and forced continuity of the pack. Here, also, were large numbers of icebergs scattered in the pack, and from a distance they seemed to offer a continuous barrier. While this was not true when the horizon was closely examined, their influence, however, coupled with the power of the great swell of the sea, was an effective bar to farther progress.

On the ice we see a number of crab-eating seals, mostly in pairs, but some in groups of five or six. They are in a sleepy mood and evidently enjoy the sharp sunbursts which now and then light up the beds of snow and the projecting icy spires with an electric glow. There are a few penguins about, and also some giant petrels; but the ornithological surprise of the day is the countless thousands of terns resting on, and hovering about, the icebergs. Great rows cover the ridges, and in some places the air is one hustling mass of bird life, all seeming to strive for a place to fly, or fighting for a resting spot on the higher angles of the bergs.

During the afternoon we saw a black zone along the northern horizon. It was a water-sky indicating that under it there was open, ice-free water. To the south, to the east, and to the west, however, there was everywhere the dazzling whiteness of the ice-blink on the heavens, offering no hope of advance.

We now tried to retrace our path, but we were held with such a firm embrace that we could not gain sufficient room to turn. At six o'clock the press-

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ure slackened a little and, at the same time, we saw a black line of open water about two miles westward. We headed for this and for seven long hours we struggled with full force to press between the firmly packed floes. After midnight we were again in free waters, and set a course westerly along the edge of the pack-ice.

February 19, noon, latitude $69^{\circ} 06'$, longitude $78^{\circ} 27' 30''$. The conditions permitting nautical observations are rare at the edge of the pack, because here the atmosphere is in a constant whirlpool of agitation. Storm, fog, rain, sleet and snow, are the normal conditions. One rarely gets a peep of the sun, and if by chance it should break through, it is seldom at noon or at an hour convenient for the Captain to make his reckoning. If then it happens, as it has to-day, that we obtain the observations which fix our position accurately in this lonely world of desolation, a kind of boyish rejoicing runs along the line of men on the decks; and even in the cabins, one hears comparisons. One says, "Now I am nine thousand, nine hundred and eighty-nine miles from home. It is noon, but at home they are just taking breakfast." Another says, "Everybody that I love is nine thousand miles over our starboard quarter. They are just entering upon the duties of the day." It has suddenly occurred to every one to think of home and of civilisation, for we are going farther and farther away from the known world of life and comfort into the unknown world of sterility and discomfort. To-day we know the exact spot on which we are being thrown about by a great unknown sea of mystery, and this knowledge seems to bring us

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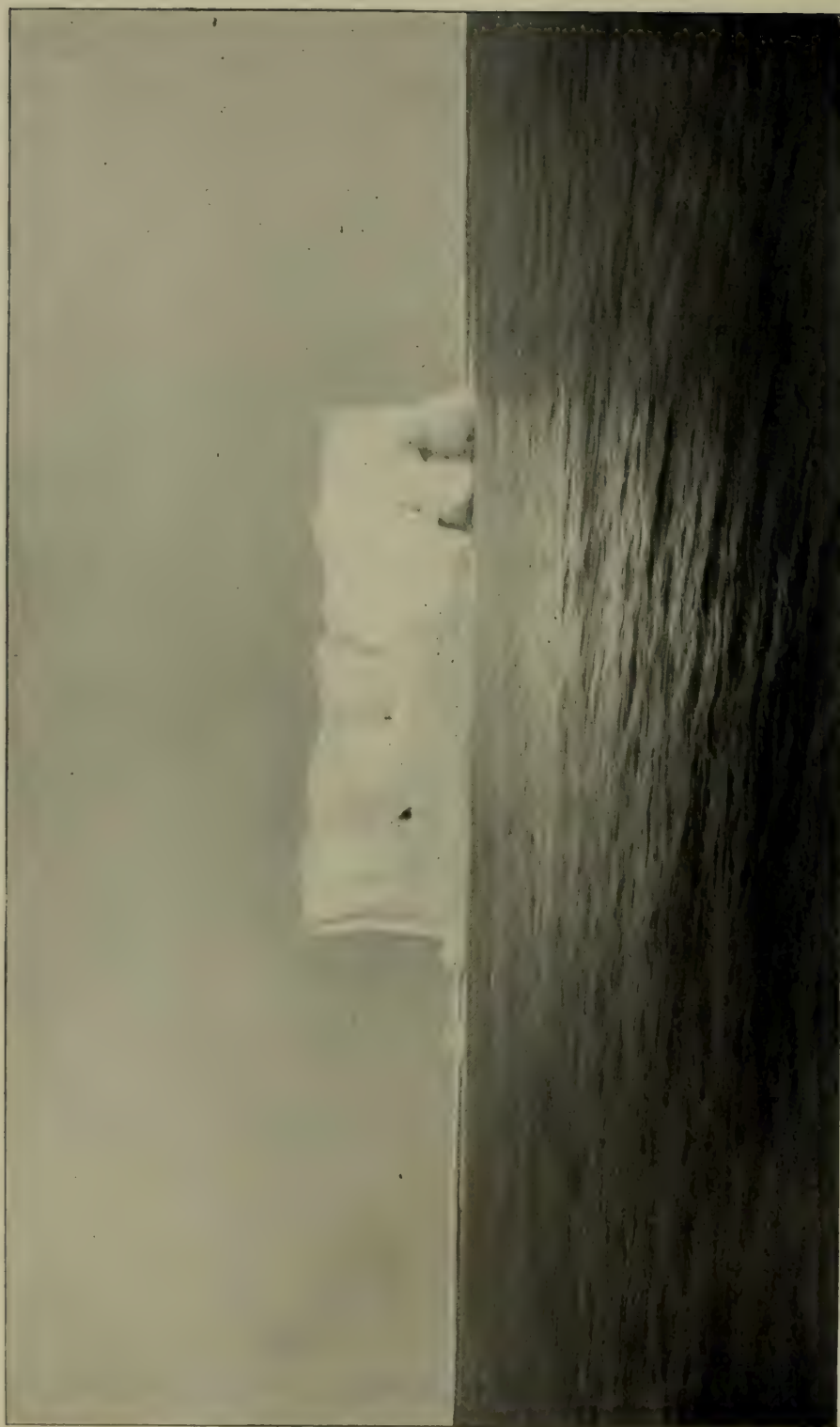
nearer home because it offers us something tangible with which to make comparisons. In reality, however, we are as hopelessly isolated as if we were on the surface of Mars, and we are plunging still deeper and deeper into the white antarctic silence. A man at the verge of starvation takes a certain comfort in knowing, though it is out of his reach, that food exists. So with us, we extract a certain amount of satisfaction out of the numbers which record our latitude and longitude to-day, though our homes are proven by the figures to be out of all possible reach for months, perhaps for years, and possibly forever.

All day we have steamed westerly along the edge of the pack, passing very many icebergs and running through occasional streams of drift-ice. We have been looking for an opening into the ice offering us a passage southward, but we have found no promising break in the compact mass. Excepting the sunburst at noon it has been a dark, dull, gloomy day. A light fall of snow, mixed with a cold drizzling rain, has fallen over us almost constantly. This has again made the decks like a sliding pond. It is humorous, but also sorrowful, to see the men, whose clothing is sheeted with a plate of ice, stumble and glide and slip from rope to rope, always holding on to something to keep from spreading on the floor or glancing overboard into the icy waters. If one falls he swears and warms the cold air by heated language, but he is at once subdued by a companion, who says, "What! you complain of such little accidents, and you an explorer? No! that is the voice of a kitchen adventurer."

CHAPTER XIII

ALONG THE EDGE OF THE PACK-ICE

For the last few days we have had under discussion a striking peculiarity of the antarctic pack. It is a noticeable yellowness in the second sheets of newly broken pieces of ice. We saw this first in the ice close to Dancoland, and at this time most of us thought it due to earthy material from the neighbouring lands. But we have seen it to-day and we have seen it every day since we left this land now hundreds of miles eastward. Can it be earthy matter? In the laboratory there have been a number of experiments made. Almost every department claims the mysterious yellow as its special preserve, but all are at work either guessing or making painstaking experiments, or observations. The discussions grow quite heated. The navigating officers, with whom I coincided, held that it was earthy matter brought down upon the sea-ice by glacial streams. The fact that it is seen most close to the land, and only in patches in our present position, seems to bear out this fact; but the geologist, who is a chemist of ability, will not agree to this, and heaps upon us all sorts of mild humorous abuse.



A Tabular Iceberg, Seen at the Pack-edge in the South Pacific. About 200 Feet High.

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Arctowski has experiments in hand which he thinks will prove a chemical origin of the knotty yellow question. None of us are chemists, and of course we cannot dispute the theory of a chemical origin, but we hold fast to our first idea. The zoölogist would not venture a theory, but he said it belonged to his department, and we tried to talk him down also, but he would say little and took our unkindly jests goodnaturedly. Late in the afternoon Racovitza came out of his laboratory all aglow with good humour, but he heaped upon us of the majority, a stream of abuse which made us, for the time, abandon all theories. He has examined the yellow stuff carefully under the microscope and finds the ice literally alive with sea algæ, which prove to be the cause of the yellow colour. For a short time this is hailed as a discovery, but presently some one finds that it had been noticed by Hooker sixty years ago. Then followed a discordant murmur on the strains, "There is nothing new under the sun."

Shortly after noon we made a sounding. We found the water 480 metres deep, under which there was a gray clay bottom. There is very little variation in the temperature of the sea at various depths. At the bottom it is 1° C.; coming up there are little variations of a half degree, and at the surface it is -1.5° C. (29.3° F.). At the time of making these soundings there were seventy-eight icebergs on the horizon, most of them southward, a few miles within the edge of the pack-ice. There were also a few lines of drift-ice flowing northward in the trough of the sea. The sea is running in easy undulations with

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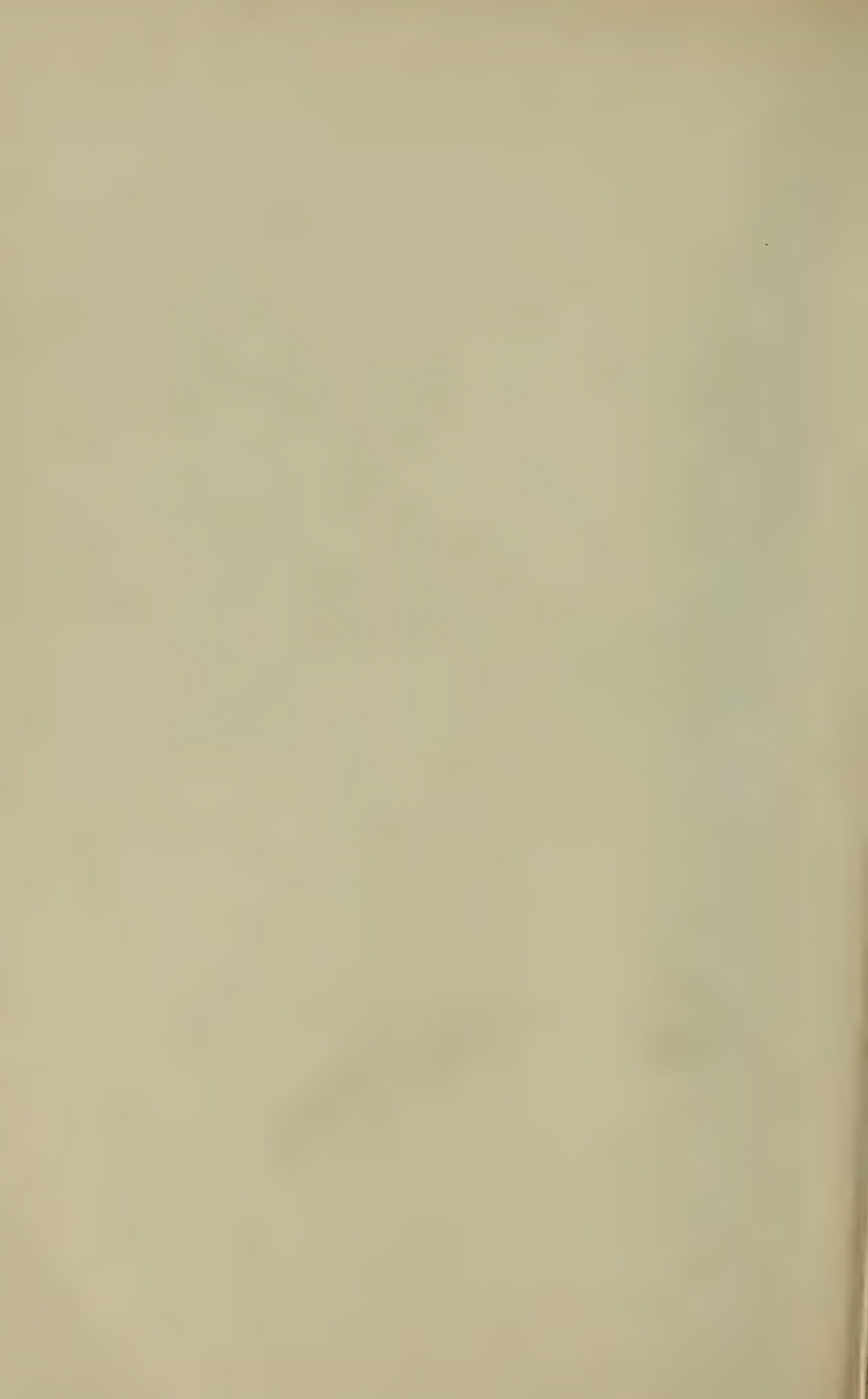
an oily, unbroken surface of blue, and though the sky is slaty, there is a charm in the solitude and a fascination in the scenic effects as the pearly mountains and streams of ice rise and fall with the sea of sapphire.

At ten o'clock to-night we turned around a point of heavy drift-ice and headed southward. Before us here there seemed to be little ice to offer an obstruction to our ambitions to reach the regions beyond. To the east and the west there was a distinct ice-blink, but southward we saw a smoky water-sky. The sea, as we advanced, became even smoother than it had been, and was entirely free of ice.

We seem to select the nights for our attacks upon the barriers of ice which everywhere have threatened to prevent our entry into the snowy preserve beyond. During the night the temperature falls, the fog, which always screens the ice in daytime, is congealed and deposited as snow; and, though the sky here at the edge of the pack generally remains dark at night, there is an incomprehensible metallic glow on the glassy surface of the water, and a sharp phosphoretic glitter from every spire and pan of ice. The night is a long twilight, and when the demons of storm are not hovering about it is a long, dreamy spell of joy. The inspiration of this solitude, the transcendental and indescribable something about this continued twilight from sunset to dawn, and the wine which one drinks with the wintry atmosphere raises the soul into a plane of superhuman existence. The glory of these midnight glimmers will haunt me for the rest of my days. But we are below the ant-



Bird's-eye View of the Pack-ice Near the Outer Edge.



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arctic circle, and the average reader will expect that we are flooded by the almost perpetual light of the polar summer day. This would be true earlier in the season; but now the sun is low on the horizon. The darkness, which is soon to throw the icy splendours into a hopeless, sooty gloom, is gathering its hellish fabric to cover the laughing glory of day. The sunless winter of storm, of unimaginable cold, of heart-destroying depression, is rapidly advancing. We are hoping to continue our voyage of exploration as long as possible, and when the darkness and cold become too great we expect to steal away and winter in more congenial latitudes. (How utterly we failed to gain freedom from the icy fetters of this heartless Frost King of the night is shown by our imprisonment later.)

February 20, 8 a. m.—We have steamed south by east, since midnight, through a sea free of drift-ice, but icebergs are in great numbers on all sides. Over the port gunwale, about two miles off, there is still the white line indicating the edge of the main body of the pack. There is a little swell, but the sea has a gray and cold aspect. There is almost no wind stirring the glassy air. The temperature has fallen to -2° C. (28.4° F.). The sky above us is smoky, with leaden streaks here and there. To the south a narrow strip of horizon is clear, and above this there are a few divisions with ragged silvery edges, beyond which is the gladdening blue of the unscreened heavens, which is so rare here. Nearly everywhere on the horizon to the south there is reflected the glitter of the ice-blink.

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The narrow sooty bands, however, which interrupt this blink, indicate that the ice is separated by open lanes of water. We shall try these lanes, so nicely mapped on the sky, for our benefit, and as our bowsprit is laid for one due south, we again stir our hopes and discouraged spirits to fresh ambitions of further discoveries. "Shall we succeed, or will the ice seize us with a final and relentless embrace?" A fog soon fell over the scene, but we continued our renewed efforts to push poleward with increasing vigour.

At ten o'clock we reached a point where the main body of the pack again refused us a path. The *Belgica*, however, will not be discouraged. She ploughs on between the heavy masses of ice, to some open lakes beyond, where she seems to gain fresh courage, and then rushes upon the offending fields with a spirit of animation altogether in keeping with that of her directors. There are about us great numbers of white and gray petrels seeming to urge us on. The fog rises and falls offering a peep, now and then, into the white world to which we are so anxious to force our way. Most of the men are standing about on the decks, offering words of encouragement to the bark as she batters and breaks the offending floes which hinder her passage. A few men, sitting on the anchor chains, have premonitions of impending danger and discuss the prospects of an antarctic winter, and the incidents of starving and freezing, cast adrift on the ice. While thus making our way energetically, and with our hopes raised to the highest pitch of anticipation, some

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mystic force brought the ice together, and early in the afternoon we found ourselves again beset—powerless either to advance or retreat.

Again, disappointed and discouraged, we tried to turn the bark in an effort to retrace our track. The entire afternoon was devoted to this effort, but we were held with fetters not easily broken. This battle with the ice has been the worst to the present. We go full speed ahead, then full speed astern. Each change in direction is followed by crash after crash, until it seems that every part of the good ship has been loosened. Either the ice or the *Belgica* must go to pieces. After many hours of hard struggling the *Belgica* obtains sufficient room to give her a good headway, and then she rushes against and upon the ice in a manner to make her mistress of the situation. Ploughing, and jamming, and crushing her way through the huge masses of ice, she scraped off her new dress of paint, and tore away many pieces of her outer sheathing. Her path was marked by specks of paint and pieces of wood, the result of scratches and bruises, but as she fought her way again out into the open sweep of the new antarctic sea she had the appearance, and we had for her the admiration, of a battleship after a destructive engagement.

While the *Belgica* was engaged battering the ice, Racovitza, Tollefsen, and myself, started out over the ice to study the life and to secure zoölogical specimens, as well as photographs. We saw numbers of penguins, some giant petrels, and a few crab-eating, or white antarctic seals; but the surprise of the day

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was a lone seal with a thick neck and a big head, altogether different from any variety which we had seen before. We at once recognised it as the "new seal" claimed to have been discovered by Borchgrevink, in 1894. While it agreed in every particular with the descriptions of the adventurous Norwegian sailor, the animal proved, upon minute examination, to be a yearling of the true sea-leopards. Borchgrevink's discovery then, in this case as in another, which will be cited later, is a myth, for the sea-leopard has been known for about one hundred years.

February 21, 10 A. M. — During the night we skirted the pack, steaming slowly westward. Now we are steaming south-west by the compass, whose variation is here 39° west. The prow is cutting clear, blue waters entirely free of ice. Along the horizon, from the north to the south-west, there is a marked ice blink. In the south-east, just over the horizon barely visible, is the edge of the pack. There are one hundred and ten icebergs visible from the mast head; of this number ten are true table-topped masses ranging, in height, from one hundred to two hundred and fifty feet, and in length from a thousand feet to one mile. All of the others were of the usual arctic type, with fantastic towers of every conceivable shape. Some five or six had the form of an easy chair, others that of a giant couch, still others assumed the forms of human faces. Some of the forms were particularly striking and needed no explanation; but at nearly every hour of the day some one went into raptures about a fetching figure, which generally required a vivid, and

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often a poetic imagination with a liberal artistic license.

It is curious that the eye generally sees what the mind intends to picture. An illustration of this point is the different forms which we ascribe to these icebergs. The Captain points to a berg, not particularly attractive to anyone, but he insists in describing upon it the face and the form of a beautiful woman, chiseled in walls of alabaster. We look, and try to be interested while Lecointe grows enthusiastic, but we see only dead white cliffs. There are some irregularities, a few delicate blue lines, some suggestive hummocks, and various dark cavities; but these we see in every berg, and with our different mental attitudes we fail to recognise the ascribed topography of a human figure. We dare not, however, admit our ignorance, for such a lack of sympathetic support, especially on a sentimental subject, would be equal to a challenge for a duel on the *Belgica*. The naturalist comes along next, he is always realistic, sometimes poetical, but never sentimental. Upon a small tabular berg there is a shapeless mass of ice-blocks, and these blocks are so piled that one cannot help but notice them. To me the thing seemed like a marble statue of England's Prime Minister, Salisbury, raised upon a huge, rounded block of granite. I heard Arcowski suggest the Egyptian Sphinx, but Racovitza insisted upon the likeness of a polar bear and some one shouted, "It moves!" At once the picture became real, and the sailors refused to believe that it was not a living bear. Racovitza's imagination was

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accepted by all, for to doubt him was to have humorous abuse and sarcastic caricatures heaped upon us for weeks. There was, however, one man with a glass. He looked intently for an hour at the thing without saying much. This was Michotte, the cook. After we had all finished our discussions, and had come to a general agreement about the bear, he shattered our allegory with a little giggle and followed it by the announcement that it was all a mistake; —“to me it looks like a pot of boiling soup.” Next to the Captain the cook is the most important personage on the ship; there are short instances when he even rises above the Captain. It was so in this case. Michotte canvassed the observers one by one, gave them his glasses and pointed out the rounded base of the huge polished kettle, and then he made steam out of our beautiful statuary in the centre. Dobrowolsky suggested that pots were generally black, but Koren, the cook’s assistant, took a look at the thing and said, “That’s just like our pots, they are always clean and white and polished.” I noticed that everybody, even Racovitza, gave a hearty assent. We dared not do otherwise, for it meant no soup to-morrow, and Kydbolla every day. We can afford to dispute with the naturalist somewhat, we can even doubt the Captain’s eyesight, but we cannot dream of endangering the good-will of Michotte,—it is, then, a pot of boiling soup, and I think Koren added it was “hot stuff;”—even this is granted.

10 P. M.—It is still light enough to write on deck, but there is a little wind coming out of the

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south which makes ungloved fingers stiff. The temperature is -4° C. (24.8° F.). At two o'clock this afternoon we again came to a region of pack-ice which loved us too well. It closed about and squeezed our sides with such force that we were powerless to resist. We have remained here since, and shall remain for the night. The engine fires have been burned down, but Gerlache says he will make another attempt to push southward to-morrow.

There has been considerable animal life about us to-day. In the air we have seen the usual songless and noiseless birds, the giant and the white petrels. Finback whales have been spouting and showing their huge blue backs in the open triangles of water. Seals have been stealing about the ship under the water, curiously examining the hull of the bark without coming to the surface to vent their curiosity by a look upon us. The speck of blackness which the *Belgica* makes in their world of perennial whiteness must be of rare interest to these semi-human sub-aqueous denizens. On the ice we have seen a few king penguins, uttering, now and then, a weird *gha-a-ah*. They were always alone, generally standing to the lee of hummocks with heads bowed, looking as solemn and dignified as deacons at a love feast. Roaming about on the floes we see the ever-restless little black-billed, yellow-footed pack penguins. This flightless bird is gregarious and sociable, and must have companions to be happy. It congregates in groups, numbering from six to thirty, and these gatherings are the only cheerful signs of life in the great silent circle around the south pole.

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The air is cold and bracing, bringing with it a wine of action which is opposed to fatigue. With it we seem to require little sleep, keeping at hard physical and mental work from early morning till midnight. With the much lower temperature the air is now getting glassy, the fog is dispersing, and the sky shows signs of clearing, with considerable colour. Mirages were seen to-night for the first time. All along the horizon, from the north-east to the south-east, there are elongated, raised and distorted masses of ice, with their bases resting upon the water. There seem to be no inverted images, as in the arctic regions.

The sun set in the south-south-west to-night at 7:30. We rarely have a sky at the edge of the pack permitting a view of this phenomenon, but we can notice that the days are rapidly getting shorter, and the light is progressively fading. Only two weeks ago we could take instantaneous photographs until ten o'clock, but now, a picture taken at eight is very feeble. With the sun almost perpetually screened by a black icy mist the sky has remained cheerless and depressing, but southerly winds seem to brush aside this gloomy curtain. Along the southern sky to-night there is a streak of gold, fringed with orange and a suggestion of carmine. At best, however, colours are sparingly distributed along the outer fringe of this antarctic pack. We have seen the stars and the moon but once since entering the Pacific, and, to the present, there have been no auroras visible.

February 22, 8 A.M.—During the night we have



Lecointe Making Observations. The Nautical Observatory.



Dobrovolski Measuring the Depth of the Snow-fall.

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rested easily in a triangular space of water, which was surrounded by large pans of ice. At about midnight a half gale of wind came out of the south-south-east and rushed through the masts with a bitter howl, but the sea remained quiet, and in our position we rested as peacefully as if in a sheltered harbour. This changed direction and augmented force of the wind separated the pack and sent it drifting northerly over the boundless sea. Taking advantage of this favourable loosening of the grip upon us, we got up steam at six A. M. and started in a renewed effort to push southward. The navigation, at best, is extremely difficult. We go ahead squeezing through breaks in the ice until our headway is barred by a floe, then we go astern to give the ship time for a new onslaught. In this way we batter and ram the ice until it seems as though every timber must break; but excepting the bruising, scraping, and polishing of her sides, the *Belgica* receives no hurts. She complains and groans and cracks and shivers, but she goes on cutting great pans of ice five feet thick, and pushing aside floes two hundred feet in diameter. She is ploughing the ice-littered sea like something animate.

To the south there is a water-sky coaxing us on to the frozen mystery beyond. Perhaps this is a temptation of the manless antarctic to ensnare and keep us for the winter; perhaps it is to reveal to us new lands and new glories in the unknown white expanse. But whatever our reward, or our punishment, for this forced intrusion, the task is difficult. There are about us to-day many signs of land, and this also

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urges us on in our hopeless effort to navigate the seemingly endless sea of ice.

Toward the south-east there are yellow land clouds, which slide over each other as though their mission was to hide the outline of some heaven-guarded coast from human gaze. Above these low-hanging clouds there are black bands of sky, indicating open lanes of water near what promises to be land. The ice, too, is what is usually termed bay-ice, with freshly broken edges, with icicles hanging from some points, and having upon the surface only small hummocks. There are no signs of pressure and the whole scene is weighted down with about twenty inches of soft snow. The animal life also indicates an approach to land. We have about us large numbers of ossifrages and magalestris, which are supposed to keep land within easy reach. The penguins and seals seen to-day are indicative of a near land mass; while the meteorologist vows that the cold dry wind coming from the south-south-east rolls off from some continental ice-capped country. Even the engineer comes forward with a sign. He has a keen nose, and says he smells the mossy rocks. But where is this mysterious land? We are not within a thousand miles of any known land. Shall we discover this land, or is it an illusion? (We afterwards saw many similar signs of land, but all proved deceptive. We saw no real land, except what came from the sea-bottom, from the time we got the last glimpse of Alexander Islands until we returned to Tierra del Fuego thirteen months later.)

Early in the afternoon our hopes were shattered.



Hauling Snow to Augment the Water Supply.



Making Soundings.

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We again reached a zone, as we so often had, farther east, where it was impossible to pass between the sheets of heavy ice. Here we rested for the balance of the afternoon and the night. We continued to search the horizon for further signs of the promised land, but most of the indications disappeared during our stay. The engine fires were burnt down. Everything about the *Belgica* is non-restful. There is little wind; the temperature remains low — 7.5°C . (-18.5°F .) An easy swell keeps the ice in a constant groan, and penguins send out their social calls. We are now accustomed to all this noise. Indeed, when tired and weary, as we are at present from long-continued anxiety, the groans of the ice and the cries of the penguins serve only to impress us with the awful solitude and the uninterrupted pearly monotony of the antarctic.

A beautiful sunset to-night has served to re-awaken our interest in this world of white sameness. Throughout the day the sky has been a cheerless gray from the zenith to a few degrees from the horizon. Low down there have been changes, now an ice-blink, now a water-sky, and again a series of seeming land clouds. The little play and change in colour, which has been evident for brief periods, is limited to a narrow strip under and over the cloud-hidden sun in the west and south. The comparative rarity of brilliant sunbursts and sunsets, in the smoky skies at the edge of the pack, has made the phenomenon to-night a real joy. At seven o'clock the long stratus clouds in the south-south-west, which were slaty in colour, became fringed with a

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touch of luminous gold. This increased gradually until the entire body of the clouds was gilded; then the sun, a great yellow ball of dull orange, sank under the creamy sheets of waving snows. The great fiery ball was only fifty seconds in passing from view, but in this time its face changed into at least ten distortions. There is a weird sadness in these faces: an expression which is singularly appropriate, because we know the good old luminary is quickly leaving us to brighten the top of the globe. She seems to feel it, for her face is like that of a dying mother sorry to leave her children alone in a world of hazard. The final parting, however, was more prolonged and more glorious than the actual presence. Soon the upper stratus of low clouds were showered with a scarlet light, which remained without apparent change for thirty minutes. Below and above this were narrow belts of bright and glistening silvery blue, while the ice was all aglow under a veil of pale magenta. Then followed a long purple twilight, which, in itself, is full of delightful charm. It is all an unimaginable dream.

February 23.—We are still firmly fixed by the compact sea of ice about us. New ice formed on every open space last night. Winter is coming over us quickly, and the season for navigating these unknown seas is now past. The rapidity with which the new ice forms, the increasing cold, and the fading light of the sun all prove this, but the Commandant is hoping against hope to push still farther into the mystic gloom of the south. Throughout the night the sky was a clear, pale purple blue, while stars of the

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first and second magnitude were struggling to display their icy glitter. The Captain obtained an observation and was able to find our position by fixing a planet and a star. Latitude $69^{\circ} 46' 30''$, longitude $81^{\circ} 59'$. It is curious how a little thing like the definite knowledge of our position raises the hopes and anticipations of everybody on board. Though such a knowledge is a mere play of figures, it assures us that we are at least on a fixed point upon the unknown under surface of the globe. We make calculations accordingly; some plan work and pleasure for the return to the world of living, and others lay down a system of effort for exploration of the new regions to which we expect to penetrate, and surely all are elated at the prospect of some other view except the inhospitable whiteness, at present on every side of our position.

At noon we made a deep sea sounding, with a long series of temperatures at various depths. We lowered five hundred and sixty metres of wire, and brought up a cup of blue clay. The temperature at the surface was at the freezing point, and at the bottom slightly warmer. We have made various excursions to obtain photos of the ice and the life, and to study the physical laws which govern the construction and destruction of the sea-ice. The pans are closely packed, but in some places there are soft buffers of pulverised ice and snow, and these are dangerous to the traveler. Gerlache stepped on such a place and promptly sank into the icy water beneath. Fortunately I saw him before he sank too far, and jerked him out by the coat collar. I tore

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his collar, and disturbed his buttons, but I had the satisfaction of keeping him from a complete bath at a temperature six degrees below zero.

The sunset is again superbly beautiful to-night. All day we have remained firmly held by the ice. The sky has been of a pale, wintry blue with alto-stratus and fracto-stratus clouds of a leaden and steel-gray colour. In the north-west and the north-east there is a water-sky, but the hopeless ice-blink is in every other direction. A dazzling whiteness has made the pack glitter to such an extent that it has become painful to walk about without smoked glasses, but to-night there is a restful lilac over the white glitter, which is a charming relief from the intense brilliancy of the day. As the sun descended into the invisible mist of ice-crystals, which always hangs over the pack, it poured out a wealth of golden light over the clouds and onto the pack. For a very brief period the clouds had the appearance of streams of hot metal, and the projecting snows were aglow like mounds of fire. As the sun sank from view a great bunch of cumulus clouds, in the south, suddenly lit up with a brilliant rose light. The yellow then vanished and the rose was thrown on the snows. The rose later faded into the purple of twilight, which for several hours gave a steady glow of lilac to the pack.

We did not retire until late to-night. There is something about our present position which suggests many premonitions. For forty-five hours we have not consciously moved, and the ice holds us with a grip which promises us no relief for forty-five



The Sailor's Recreation.



Bow of the *Belgica* After a Collision with an Iceberg.

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weeks. There is a cheer and a new joy in the curious colour effect of the coming night, and this is about the only encouragement in our present prospects. We have persistently tried, to-day and to-night, to steam northward and southward, and eastward and westward, but the *Belgica* refuses to mind the helm, while the ice disputes our right of way. The fact is forced more and more upon us that we are fixed for the winter, and destined to pass through the first long antarctic night. Gerlache has all along manifested an inclination for wintering in the pack, but every officer has been so much opposed to this that the Commandant did not openly betray his disposition. To-night Gerlache is sounding the sentiments of all hands, upon their willingness to winter in the ice. Everybody is opposed to it, but if it must be, they are inclined to submit gracefully to the unquestionable fate.

The main objections offered to our voluntary stay in the pack are the ignorance of the home authorities of our whereabouts, and the certain death which would follow the loss of the *Belgica* by pressure, or by other accidents. If an expedition has planned to winter in the unknown antarctic pack she should have two vessels, so that if one is crushed another might remain to bring home her precious cargo of human life, and the records of the equally precious work. If this is not the fortune of an expedition, there should, at least, be left at home a clear outline of the prospective route. It is unnecessarily hazardous to trust to the pitfalls and certain misfortunes of polar work without such safeguards.

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In our case no one knows of our whereabouts. If our vessel should be lost, no relief could possibly reach us, because it is not definitely known where we may be found. Death by freezing and starvation would be our lot if our trusty ship were disabled, and such a possibility must always remain in view, in a battle against the ponderous polar-ice. With this prospect before us we do not take kindly to a voluntary berth among the ever restless floes during the many weeks of sure darkness and unknowable cold.

February 24.—A sharp southerly wind has been blowing all night. The sky is again gray and cheerless and full of promise for an early tempest. Sailors at sea rarely pray for a tempest, but this is the only hope we now have of securing freedom from the ice. We are longing for a gale of wind. We are not particular from what direction, anything will do so long as it breaks the ice and gives us a little room. With this promise before us, and while still beset, the Commandant comes forward with the first of a long series of new programmes. We are to gain the open sea northward, as quickly as possible, from here make a line of soundings from the edge of the pack northward, and another line parallel to the western shores of Grahamland, then go to Yankee Harbour, Deception Island, and return to Belgica Strait for a short period. As the season for ice exploration ceases we are to go to Ushuaia, where Racovitza and I are to be left for the winter to make zoölogical and anthropological studies of the Fuegian life, while the *Belgica* returns to Buenos Aires to winter. Next season we are to go south of Australia to Victorialand.



The Hummocks of a Pressure-Angle.



Cestrugi.

CHAPTER XIV

OVER UNKNOWN WATERS INTO THE FROZEN SEA

February 25. — The expected storm has not struck us, but the ice has separated a little and offers us a chance to push westerly. We are passing through a loose pack with much new ice, which offers but little resistance to the vessel. On the ice there are many groups of small penguins, and we have also seen several royal penguins. Many snowy petrels follow in the wake of the ship, but they are silent companions, never uttering a song or a cry of delight or fear, always gliding lightly in the air and dropping easily into the water to seek the pelagic fish, which is their food. There is no wind to-day. The temperature is again higher — 3.5° C. (25.7° F.), and the sky is lined with stratus and alto-stratus clouds of the usual steel gray. Our position at noon was latitude $69^{\circ} 17'$, longitude $82^{\circ} 24'$.

From here we again pushed out into the open sea northward, and following closely the edge of the pack westerly, we continued our cheerless voyage still in search of a promising bay or open lead which might permit us to push to a higher latitude. At noon on the twenty-seventh our position was 69°

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26', longitude $86^{\circ} 46'$. After the ensnaring powers of the pack-ice, which we have learned in the past few weeks, we were not eager to put ourselves again in a position to become entangled. For such an entanglement would now mean confinement. The season for a campaign to the far south is past. The nights are becoming long and black, and new ice is forming on every side; but in spite of these forbidding signs M. de Gerlache believes it incumbent upon himself to abandon the new programme, and push heedlessly into the freezing waters to make as strong an effort as possible to beat the "farthest south" of other explorers.

The entire scientific staff are opposed to this effort, because it is thought too late in the season. No direct opposition, however, was offered when the *Belgica* was again headed southward. She was forced into the pack and out again, time after time, making after each rebuff a new effort farther westward. On February twenty-eighth we were forced to take to the ice that the ship might better ride out a howling storm.

I can imagine nothing more despairing than a storm on the edge of the pack. At best it is a cold, dull, and gloomy region, with a high humidity and constant drizzly fogs. Clear weather is here an exception. Storm with rain, sleet, and snow, is the normal weather condition throughout the entire year. During the day of the twenty-eighth we are unable to get a glimpse of the sun, and are in consequence in doubt as to our actual position. There is something about the sea and sky which promises a night

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of unusual terrors. The wind comes in a steady torrent from the east, and with it come alternate squalls of rain, sleet, and snow. Hour after hour it blew harder, and before night it brought with it a heavy sea studded with icebergs — moving mountains of blackness. The *Belgica* runs westerly before it, almost under bare poles, and edges closer and closer toward the fragments of ice to the south, where the sea is easier. The sky to the north and east is smoky and wavy, as if a number of huge fires were there sending out gusts of smoke, and on the southern sky there is a bright pearly zone. This is an ice-blink, a reflection of the ice beyond our horizon upon the particles of watery vapour suspended in the air. As night comes upon us it becomes necessary to choose between the forbidding blackness of the north and the more cheerful, but less hospitable, whiteness of the south. With icebergs on every side, always in our course, coming as suddenly out of the thickening darkness as if dropped from the skies, it is not wise, or prudent, either to move out of, or to rest in, our position. To be more friendly with the ice, or to rid ourselves entirely of its companionship, is plainly our duty.

We have decided to seek the harbouring influence of the pack, as an experiment, to ride out the increasing fury of the tempest. The *Belgica* is headed southward, and quickly plows through the trembling icy seas. But the noise and commotion which come to a climax every time she rises to the crest of a great swell, are terrible. The wind beats through the rigging like the blasts out of a blow-

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pipe, the quivering masts sweep the sky with the regularity of a pendulum, and the entire ship is covered with a sheet of ice. As the eye drops over the side of the ship the sea glitters with the brightness of a winter sky. This brightness of the sea, with the sooty blackness of the heavens above it, formed a weird contrast, never to be forgotten. Here and there are sparkling, semi-luminous pieces of ice which spring from the darkness with meteoric swiftness, and are again as quickly lost in the gathering blackness behind us. These fragments increase in number and in size as we press poleward; but the *Belgica* strikes and pushes them aside as easily as a broom removes dust.

After a short but very exciting time, the pieces of ice become more numerous and of larger dimensions, and the bergs are so closely grouped that further progress seems impossible. The sea rolls more and more, in long easy swells, as we pass through the ice. This eases the ship and makes matters more comfortable to the sufferers of seasickness. I must hasten to confess that about one-half of us are thus afflicted at this time. Still, we try to be cheerful. I cannot imagine a scene more despairing, though, than the *Belgica* as she pushes into the pack during this dark night. The noise is maddening. Every swell that drives against the ship brings with it tons of ice, which is thrown against her ribs with a thundering crash. The wind howls as it rushes past us, and comes with a force which makes us grasp the rails to keep from being thrown into the churning seas. The good old ship

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keeps up a constant scream of complaints as she strikes piece after piece of the masses of ice. Occasionally we try to talk, but the deafening noises of the storm, the squeaking strains of the ship, and the thumping of the ice makes every effort at speech inaudible. With our stomachs dissatisfied, and our minds raised to a fever-heat of excitement, and with the prospect of striking an iceberg at any moment and sinking to the bottom of the sea, we were, to say the least, uncomfortable. When we had sufficiently entered into the body of the pack, and were snugly surrounded by closely-packed ice-floes, the sea subsided, and here the overworked ship rested for the night.

In the morning the wind changed to the north-east, and the ice separated, leaving long open leads of water. These leads offer a tempting highway poleward, and Gerlache was not long in deciding the course. With a fair wind pressing the sails and with steam, we push southward. The navigation is not easy, still it is less difficult at this time than it usually is in an antarctic pack. The pans are small — from fifty to a hundred yards in diameter and about four feet thick. They are separated by quantities of pulverised fragments and discs of new ice.

Evenly scattered about in the icy expanse are numerous icebergs; usually about two hundred can be counted from the crow's-nest. The navigating officer remains at the masthead, and directs the course of the ship. It is exciting navigation. The sky in the north is lined with heavy, lead-coloured

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clouds, and in the south there is the ever-bright ice-blink. Petrels in large numbers and in great varieties hover about us, as if to ask our business in their domain. Penguins walk about on the ice, uttering squeaky noises which re-echo from berg to berg. Seals, lazily sunning themselves, come to the edge of the floe to see the human intruders. Meanwhile the ship is forced on in a wild manner into the ice. Now she is running upon the floes to break them; again she is pushed between to force them aside; but always she is fighting an uneven battle against the huge masses of ice.

After two days of this ice-ramming, we found that we had passed through about ninety miles of ice. We are now made to realise that further progress is out of the question. The ice is too closely packed; and the floes here are heavier; it is no longer practicable to break them, or push them aside. We are so closely hugged, indeed, that movement in any direction is impossible. To the south there are several lakes visible from the crow's-nest, and to the north-west there are also spaces of open water; but after several efforts we found ourselves unable to reach these. On the fourth of March, we were forced to admit our inability to extricate ourselves. Our position at this time was latitude $71^{\circ} 22'$, longitude $84^{\circ} 55'$ — about three hundred miles across the polar circle and about 1,100 from the geographical pole. The nearest land from here is the still unknown group of Alexander Islands, about three hundred miles eastward.

We are now again firmly stationed in a moving sea

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of ice, with no land and nothing stable on the horizon to warn us of our movements. Even the bergs, immense, mountainous masses, though apparently fixed and immovable, sail as we do, and with the same apparent ease. The astronomical positions which we obtain from the sun and from the stars indicate to us that we drift from five to ten miles per day. It is a strange sensation to know that, blown with the winds, you are moving rapidly over an unknown sea, and yet see nothing to indicate a movement. We pass no fixed point, and can see no pieces of ice stir; everything is quiet. The entire horizon drifts with us. We are part of an endless frozen sea. Our course is zigzag, but generally west—we do not know our destination, and are always conscious that we are the only human beings to be found in the entire circum-polar region at the bottom of the globe. It is a curious situation.

March 5.—We are not yet prepared to resign ourselves to the doubtful destiny of an unknowable life in the restless sea of ice. We still hope against hope that some favourable force will separate the ice and permit us to retreat. Day after day we have tried to slide into some promising lead, but each effort has been a bitter disappointment. The weather is getting colder and clearer. The pack and the sky is touched with new charms of colour, and the life is full of inspiration. Altogether, the new region in which we are now held is more hopeful and less monotonous than the hundreds of miles of desolate icy waste through which we have passed. If there were only some sort of relief at hand for

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our rescue, in case the ship were crushed, we would gladly make arrangements to pass the winter and the long night here. If our vessel should be destroyed no one at home could possibly know the location of our wanderings, or the site of our final destruction, and with our equipment we could not navigate the Cape Horn seas to a land of human habitation. Our faith then is pinned on the *Belgica* ; our life is linked with hers. If she gains freedom our liberty is assured ; if she sinks, we shall all go to an icy grave.

The drift of conversation for several days has been in this strain. We must seek to divert thought to other channels, for to constantly weigh the prospects of death and misfortune is to cast the mind into a melancholy state, from which it is difficult to arouse. To be caught in the ice is, after all, the usual luck of polar explorers. It is a life of hardship, of monotony, and isolation, full of certain dangers and uncertain rewards. For success there awaits honorable reward, but for failure there is always ready a storm of condemnation. Our success to the present has been such that we feel proud of our work. We have seized the records to-day and hope to elaborate our observations. Everything which we have done will require careful revising, and this brings to us a new interest and a brighter promise. It serves to divert our attention from the darker side of our future.

Outside, the conditions, for the past few days, have been more cheerful, though there is every indication of our being permanently fixed here. The nights are clearer and colder, but longer and



A Lake. The Sporting Place of Whales, Seals and Penguins.



Moonlight Photograph of the *Belgica*, May 20, 1898.

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darker, and the mercury is sinking into the bulb. When on the ship we brood over, and complain of our miserable lot, but when we stroll over the pack, interview the groups of friendly penguins, seek the company of the gregarious seals, watch the petrels dive into the icy waters, and behold the restfulness and contentment of this life within its lonely world of ice, we are encouraged to stay and experience the unknown conditions. There is now also a short glory in the sky as the sun departs, and a long scene of joy in the curious colours playing on the ice. Every day we see new charms in our surroundings, which makes us almost hope that we will stay to study the strange effects. The warm golden sunsets, followed by a long soft blue twilight, are now a daily delight. The milky white of the old floes, with the glitter of its miniature mountains, is under a thin veil of evening lilac. The new ice, which is quite as extensive as the old, takes the heavenly colours and glows in lakes of gold, while the water separating these is a most delightful azure. There is a fascination in all this; there is a spirit of contentment in the white silence, which hangs over all.

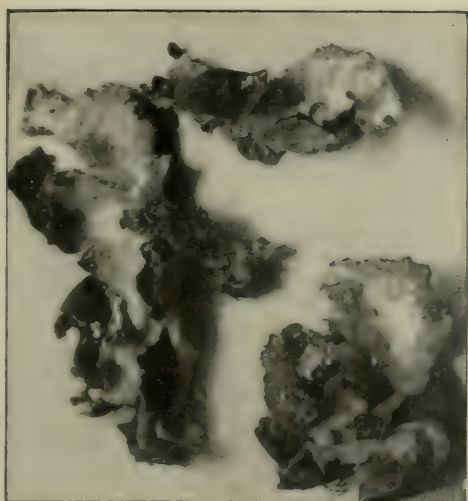
March 4.—This morning a bunch of sharp rays of light pierced my port as the sun rose over the icy stillness of the north. It was like a bundle of frosted silver wire, and it served well the purpose of an eye-opener. Sleep here is an inexpressible dream. It does not matter how difficult the work, or how great the anxiety, we sink easily into prolonged restful slumbers. We awake rested, refreshed,

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and full of youthful vigour, always ready for the day's task. In the first days of our life in the pack we ate when we were hungry, slept when we were tired, and worked when the spirit moved us. (But later we were never hungry, always tired, and the spirit never moved us.)

This morning the vessel was allowed to rest quietly, though there was considerable water about. On board we are adjusting things to guard against the expected heavy seas, which we anticipate when we leave this accursed pack. At noon we took a sounding and struck bottom at 530 metres. Soon after, steam was raised and we began to ram through the ice northward. We now intended to visit Peter Island if possible. At first we made good progress. The young ice was five inches thick, but this we cut like butter. The large old floes were either pressed out of our way, or broken. There were many groups of small penguins, shedding feathers and resting with their ragged coats in the lee of hummocks. There were also many seals on the ice. On the whole, however, our hard efforts were poorly rewarded, for, after battling with the ice six hours, we had gained not more than two miles and were again as snugly beset as before.

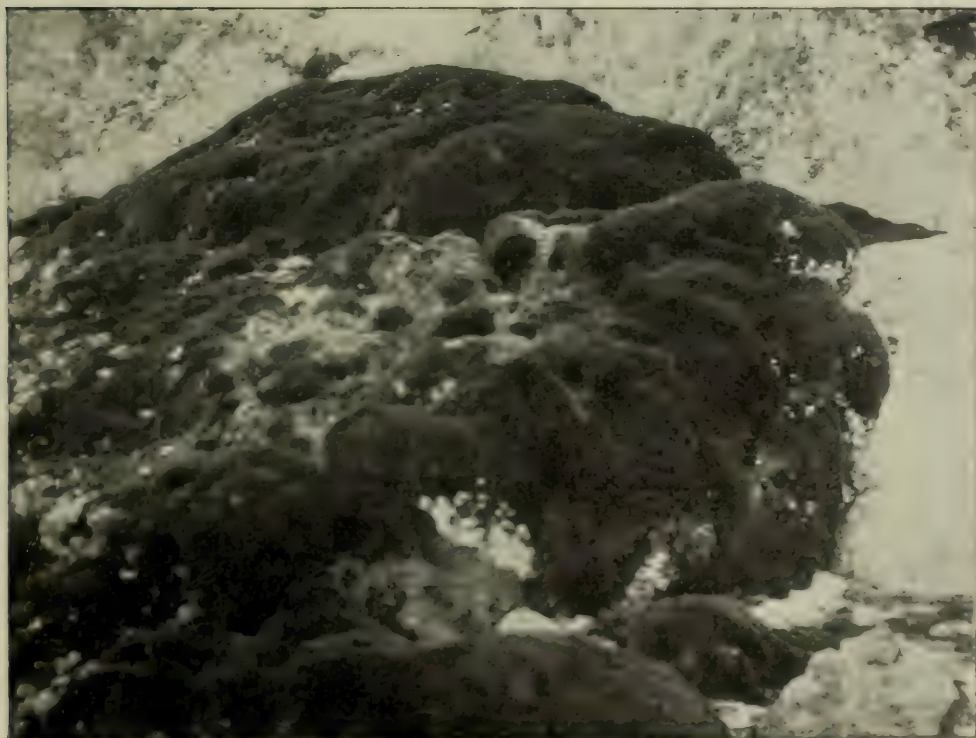
We have wearied of pushing southward this season, and are discouraged in our ability to move in any direction, but we have tried hard to make a higher latitude. Nature frowns upon us and refuses to reward our dearly-bought venture. She guards the mysteries of the frozen south with much jealousy. She tempts us by permitting a small



Lichen.
(Gyrophora zellea (L.) Nyl.)



Lichen.
(Usnea sulphurea (Müll) T. Fr.)



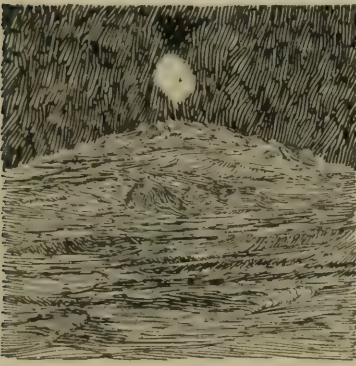
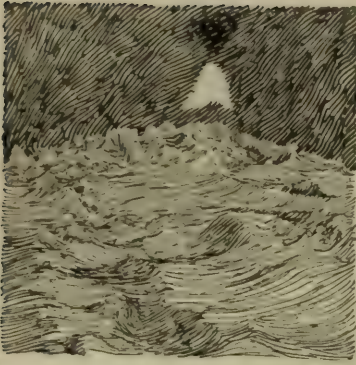
Mosco Andreae a laxifolia H. and W.

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advance and a long look ahead, but when we have resolved to force on into the white blank, the icy gates close as if to say, "You can look, but you must not enter." A water sky, a land blink, or some other sign, indicative of land or open water, is constantly before us and these are, to the polar explorer, like the Star of Bethlehem to the children of Israel. They perpetually urge us on. We burn down the fires and wait impatiently for better success on the morrow, feeling always that we have won our success, thus far, by our own hard efforts, and by the same methods we hope to master the barriers now walled around us. Pressing ice, blasting head winds, blinding snow squalls, and all the worst elements of sea and weather combine to bewilder and defeat us.

The south polar lands are carefully shielded and fenced off by the circumpolar pack. The regions beyond the outer edge are not to be secured from the depths of mystery by a dash or an assault. The fortifications are more firmly laid than ever a human mind suggested. The prodigious depths of snow above, and the endless expanse of ensnaring sea around are mostly impregnable to man. He who contemplates an attack on this heatless under-surface of the globe will find many tempting allurements and many disheartening rebuffs. Such has been our experience. The battle, however, should be fought, though it promises to be the fiercest of all human engagements. Science demands it, modern progress calls for it, for in this age a blank upon our chart is a blur upon our prided enlighten-

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Moon Faces.

ment. A measure of success is certain to follow, and the victory should be crowned by the "Stars and Stripes."

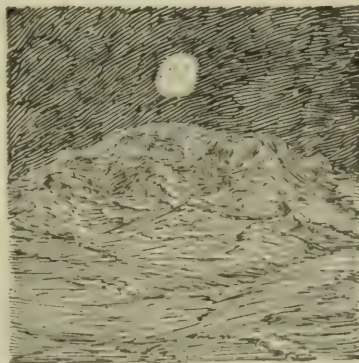
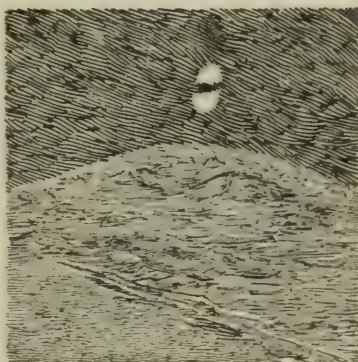
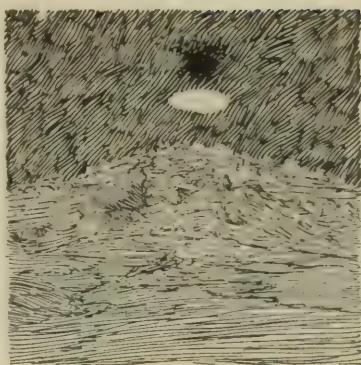
Except for the little touch of colour at sunrise this morning, the weather has been one of a type which we now style gray days. These gray days are entirely characteristic of the antarctic. There is no brightness, no sparkle, no moving wind or water, nothing to infuse new life or to lighten our spirits. The atmosphere is heavy, but not opaque, the sky is low and gray, the extensive pans and bands of new ice are a smoky colour, the water is leaden, and only the snow-decked old pans form a contrast to the gray monotony, and even these take on a dirty aspect. All of this is impressed upon the mind, and when taken together

with our immobility it sets up a greyness in our moods. To-night we saw a sight which aroused us to other thoughts. The sun had set rather tamely, leaving only a narrow zone upon which colour was poured; this zone was light blue at the water-line, a little darker above, merging into a

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violet, and then into an orange red, and over all was a mouse-coloured sky. These colours soon vanished, leaving a lemon colour which followed the sun on its journey eastward. At about eight o'clock a speck of fire was seen above the purple ice northward, but neither the ice nor the sky showed any signs of a reflected light. The sky was a dark purple blue. All was still and dead; there was not a breath of air stirring. The dull flame slowly increased in size and changed its form with marvellous rapidity. Above it there was a little blackness suggestive of smoke, and under it was a cone-like image of a mountain peak from which the fire and smoke seemed to ooze. Excitement ran high on the *Belgica*. The thing came upon us out of the smoky purple

sky with the suddenness of a flash-light. To many of us it seemed like a volcanic fire; to all it was an awe-inspiring, but fascinating, puzzle. As it rose slowly higher it seemed to pull the mountain up with it; presently we noticed that the weird object had not only an upward movement but also a lateral progress.



Moon Faces.

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Then the fire separated from the mountain and later the smoke separated from the fire, and then both smoke and mountain vanished, leaving only a cone of rayless flame. Every few seconds for fifteen minutes this extraordinary object underwent a remarkable transfiguration; now it was oblong with its greatest diameter parallel to the line of the horizon, again it formed an inverted cone, at other times it became semi-circular, and, most curious of all, it was a globe divided by a line. There was at no time any sign of luminosity about the spot. It remained a dull red, fading into orange, and when it had ascended about five degrees it assumed the form of a ragged ball of old gold. By this time we had discovered that it was the moon making anomalous faces as it passed through the icy atmosphere resting on the pack. (It was a sight which we saw many times afterwards, and it was always full of a sort of weird glory, of which we never tired.)

March 13. — For ten days we have had clear skies with a falling thermometer, and though the ice has spread considerably, leaving large open leads and lakes, new ice has covered the water so quickly that we have been unable to push out of our icy imprisonment. Few of us now entertain any hope of seeing real water or land again until the Frost King loosens his grasp upon us. There is considerable difference of opinion as to our present position. When one walks about the decks the men are frequently heard discussing the recent efforts to push out of the ice. They say the attempts have been half-hearted, and that we are in the pack to winter by in-



M. van Rysselberghe at the condenser, which was converted into a snow melter. This apparatus, by the combined ingenuity of van Rysselberghe and van Mirlo, was taken out of the engine-room, placed on deck, and so altered that it burned seal blubber. From this the *Belgica* was supplied with water.

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tention. This opinion is shared also by some members of the scientific staff. Within the past four or five days the ice has been much separated, but our efforts to force out have been made with half-steam and for short periods. There is a claim of indifference among the officers as to whether we return to South America to winter, or harbour in the pack, and this indifference is shown in the feeble attempts to navigate the ship.

Most of us have assumed the responsibility of criticising the management, and all blame the director for entering the main body of the pack at the season's end. After airing opinions, though adverse and bitter to the men in charge, everybody feels better. These complaints are a sort of safety-valve, and the grunts are taken good-humouredly. The opportunity to find fault is the privilege of men on the threshold of polar darkness, and, according to my experience, the members of every expedition do it freely, but such sentiments are generally expunged from the narratives. In spite of our disheartening prospects, fits of melancholy, and spells of fault-finding, there is, in general, hearty laughter and jolly good feeling on board. In the forecastle the men sing, whistle, and squeeze out old tunes on the accordion. On deck they kick and dance and tell funny stories. In the cabin the music boxes are kept on cheerful notes, and altogether we are making the dead world of ice about us ring with a boisterous noise. Even the most disheartened among us now begins to see new charms in the curious chance which may make us the first of all human beings to pass through the long antarctic night.

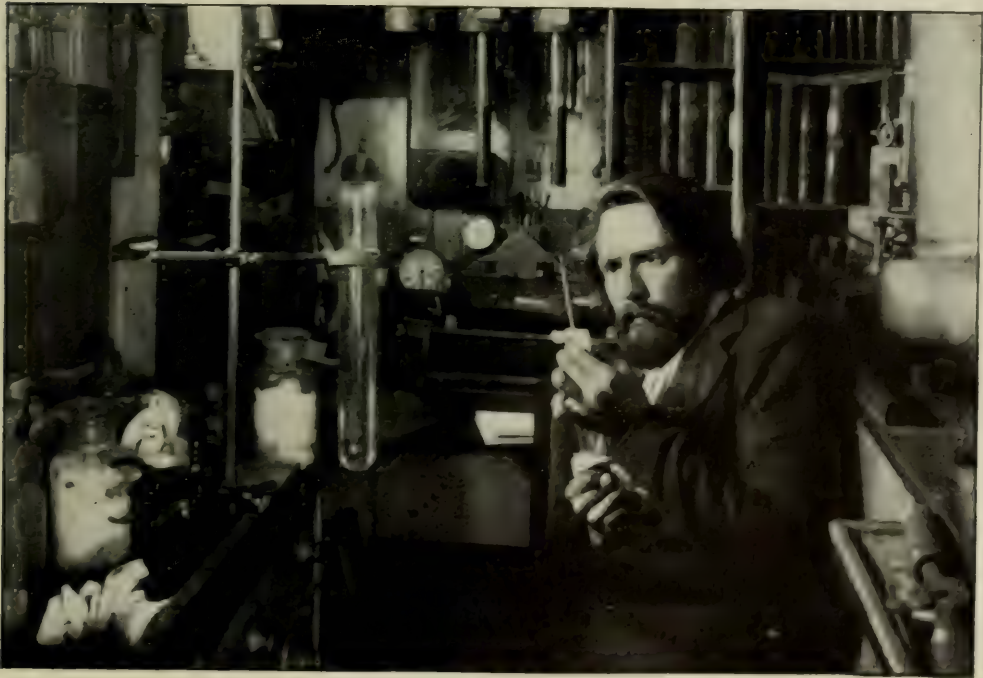
CHAPTER XV

HELPLESS IN A HOPELESS SEA OF ICE

WE are now doomed to remain, and become the football of an unpromising fate. Henceforth we are to be kicked, pushed, squeezed, and ushered helplessly at the mercy of the pack. Our first duty is to prepare for the coming of the night, with its unknowable cold and its soul-depressing effects. Aboard, the crew are re-storing coal and re-arranging the store of provisions. The scientific men are making plans for a year of observations, while the cook is racking his brain to devise some new dishes to appease our fickle appetites. His soups are full of "mystery," and the "embalmed meats" are on every tongue for condemnation. Outside there has been a rapid transformation. The summer days of midnight suns are past, and the premonitory darkness of the long night is falling upon us with marvellous rapidity, for in this latitude the sun dips below the southern skies at midnight late in January. This dip increases, and sweeps more and more of the horizon every day until early in May, when the sun sets and remains below the horizon for seventy-one days. When we first skirted the pack-ice in February there were a



Racovitza at the Microscope.



Arctowski in the Laboratory.

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few hours, at midnight, of bright twilight. The darkness then was not sufficient to prevent navigation throughout the night; but now it is really dark for eight hours. The temperature, too, is falling rapidly. We have been led to believe by the experiences of previous antarctic explorers that the temperature, compared with arctic, would be more moderate; but in this we are disappointed. An icy wind comes from the south, brushing the warm, moist air seaward and replacing it by a sharp, frigid atmosphere. The temperature falls to ten degrees below zero, then to twenty (and later it descends to thirty, forty, and finally forty-five).

Soon after we entered the main body of the pack a fortnight ago, it was discovered that we drifted with the ice in a south-westerly direction. We concluded, at that time, that we were in a current. The shallow sea and the speed with which we moved were in favour of this theory; but now we are drifting north-westerly, and we begin to doubt the existence of a current. The ease with which the entire horizon, with its numerous mountains and fields of ice, sails over the invisible sea makes us anxious as to our destiny. If we remain here, on this blank space of the globe, where will we find ourselves a year hence? Will it be north, south, east or west? In this drift it is possible that the ship may be dragged over a submerged reef, and it is also possible that we may be carried onto a rocky shore, or against the formidable land-ice. In each case destruction of our vessel and a miserable death for all must be the inevitable result.

To forestall such a future we now ascend to the

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crow's-nest daily and with the telescope search the horizon. New bergs come over one part of the circle, old ones disappear in other directions. Appearances of land are often noted, but such appearances are no longer credited. New crevasses form, old ones close, but on the whole it is, day after day, the same heaving sea of frozen whiteness. Nevertheless the views are encouraging, and they now and then revive the dying hope of release from the icy prison. There is promise in the movement of the bergs, the continued swell of the sea, and the slow mysterious turning of the floes, together with the present northerly drift. The fact that each floe persistently remains as a single individual, and refuses to unite with its neighbours to form a conglomerate mass, which would effectually and finally cut off all hope of a retreat this year, is a pleasant thought. A brisk storm would easily separate these floes, and the open water, but ninety miles north, would carry us on its stormy bosom to a more congenial climate for the winter.

Last night was clear and blue. We knew from the stillness of the air and crackle of the ice that it would be very cold, and so it proved. At six o'clock it was -14.6°C. (5.72°F.), at midnight, -20°C. (-4°F.). A number of royal and small penguins and some seals were led by curiosity to visit us. They called, and cried, and talked, and grunted, as they walked over the ice about the ship, and were finally captured by the naturalist and the cook, who had an equal interest in the entertainment of our animal friends and in their future destiny. A few nights past a sea

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leopard interviewed the meteorologist, Arctowski. The animal sprang suddenly from a new break in the ice onto the floe, upon which Arctowski had a number of delicate meteorological instruments, and without an introduction, or any signs of friendship, the animal crept rapidly over the snow and examined Arctowski and his paraphernalia with characteristic seal inquisitiveness. The meteorologist had nothing with which to defend himself, and he didn't appear to relish the teeth of the leopard as it advanced and separated its massive jaws with a bear-like snort. He walked around the floe, the leopard after him. The seal examined the instruments, but they were not to its liking, and as to Arctowski, it evidently did not regard him of sufficient interest to follow long, for after it had made two rounds the seal plunged into the waters, swam under the ice and around the floe, and then raised its head far out to get another glimpse of the meteorologist. Thinking that the creature contemplated another attack, Arctowski made warlike gestures, and uttered a volley of sulphureous Polish words, but the seal didn't mind that. It raised its head higher and higher out of the water, and displayed its teeth in the best possible manner. Now and then its lips moved, and there was audible a weird noise, with signs which we took to be the animal's manner of inviting its new acquaintance to a journey under the icy surface, where they might talk over the matter out of the cold blast of the wind, in the blue depths below.

March 15.—The weather is remarkably clear. There is no wind, no noise, and no motion in the

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ice. During the night we saw the first aurora australis. I saw it first at eight o'clock, but it was so faint then that I could not be positively certain whether it was a cloud with an unusual ice-blink upon it or an aurora; but at ten o'clock we all saw it in a manner which was unmistakable. The first phenomenon was like a series of wavy fragments of cirrus clouds, blown by strong, high winds across the zenith. This entirely disappeared a few minutes after eight o'clock. What we saw later was a trembling lace-work, draped like a curtain, on the southern sky. Various parts were now dark, and now light, as if a stream of electric sparks illuminated the fabric. The curtain seemed to move in response to these waves of light, as if driven by the wind which shook out old folds and created new ones, all of which made the scene one of new interest and rare glory.

That I might better see the new attraction and also experiment with my sleeping-bag, I resolved to try a sleep outside upon one of the floes. For several days I had promised myself the pleasure of this experience, but for one reason or another I had deferred it. At midnight I took my bag and, leaving the warmth and comfort of the cabin, I struggled out over the icy walls of the bark's embankment, and upon a floe three hundred yards east I spread out the bag. The temperature of the cabin was the ordinary temperature of a comfortable room; the temperature of the outside air was -20°C. (-4°F.) After undressing quickly, as one is apt to do in such temperatures, I slid into the fur bag and rolled over the ice until I found a depression suitable to my

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ideas of comfort. At first my teeth chattered and every muscle of my body quivered, but in a few minutes this passed off and there came a reaction similar to that after a cold bath. With this warm glow I turned from side to side and peeped past the fringe of accumulating frost, around my blow-hole through the bag, at the cold glitter of the stars. As I lay there alone, away from the noise of the ship, the silence and the solitude were curiously oppressive. There was not a breath of air stirring the glassy atmosphere, and not a sound from the ice-decked sea or its life to indicate movement or commotion. Only a day ago this same ice was a mass of small detached floes, moving and grinding off edges with a complaining squeak. How different it was now! Every fragment was cemented together into one heterogeneous mass and carpeted by a hard, ivory-like sheet of snow. Every move which I made in my bag was followed by a crackling complaint from the snow crust.

At about three o'clock in the morning a little wind came from the east. My blow-hole was turned in this direction, but the slow blast of air which struck my face kept my moustache and my whiskers, and every bit of fur near the opening, covered with ice. As I rolled over to face the leeward there seemed to be a misfit somewhere. The hood portion of the bag was as hard as if coated with sheet-iron, and my head was firmly encased. My hair, my face, and the under garments about my neck were frozen to the hood. With every turn I endured an agony of hair pulling. If I remained

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still my head became more and more fixed by the increasing condensation. In the morning my head was boxed like that of a deep sea-diver. But aside from this little discomfort I was perfectly at ease, and might have slept if the glory of the heavens and the charm of the scene about had not been too fascinating to permit restful repose.

The aurora, as the blue twilight announced the dawn, had settled into an arc of steady brilliancy which hung low on the southern sky, while directly under the zenith there quivered a few streamers; overhead was the southern cross, and all around the blue dome there were sparkling spots which stood out like huge gems. Along the horizon from south to east there was the glow of the sun, probably reflected from the unknown southern lands. This was a band of ochre tapering to gold and ending in orange red. At four o'clock the aurora was still visible but faint. The heavens were violet and the stars were now fading behind the increasing twilight. A zone of yellow extended from west around south to east, while the other half of the circle was a vivid purple. The ice was a dark blue. An hour later the highest icebergs began to glitter as if tipped with gold, and then the hummocks brightened. Finally, as the sun rose from her snowy bed, the whole frigid sea was coloured as if flooded with liquid gold. I turned over and had dropped into another slumber when I felt a peculiar tapping on the encasement of my face. I remained quiet, and presently I heard a loud chatter. It was uttered by a group of penguins who had come to interview their new companion. I hastened

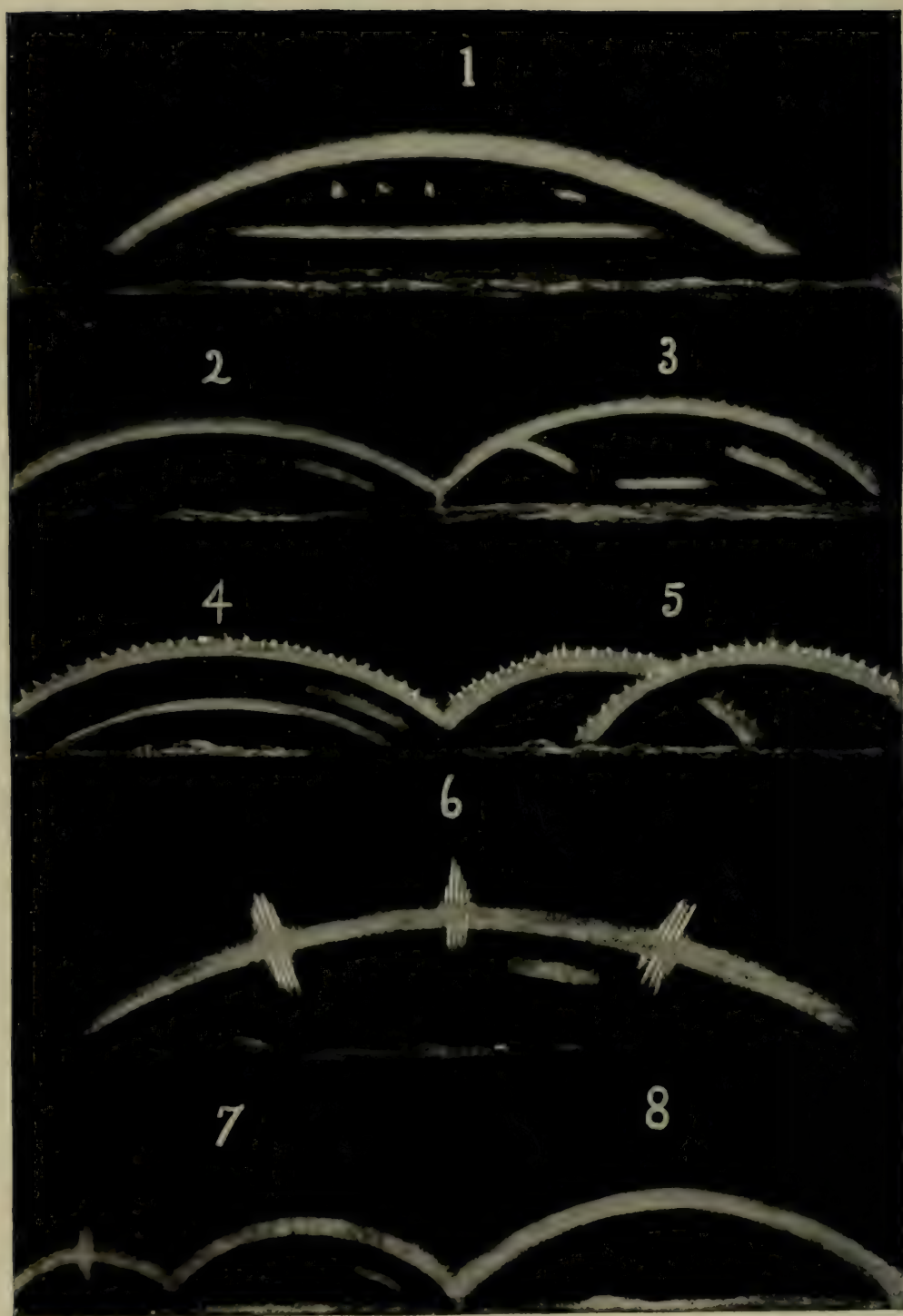
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to respond to the call, and, after pounding my head and pulling out some bunches of hair, I jumped into my furs, bid the surprised penguins good morning, and went aboard. Here I learned that Lecointe, not knowing of my presence on the ice, had taken me for a seal, and was only waiting for better light to try his luck with the rifle.

CHAPTER XVI

BIRD'S-EYE VIEW OF THE PACK—AUTUMNAL TEMPESTS

ON the morning of the 16th several of us went to the crow's-nest to get a bird's-eye view of the pack. Only two could rest in the nest at one time, and at best it is a shivery roost, but Arctowski and I resolved to enter it this morning and there spend an hour in study and philosophy. We climbed up over a series of rope ladders which were coated with an inch of hoar-frost in large crystals. The metallic jingle of these crystals made a music full of curious interest, and the gem-like glitter of the masts fired by the silvery beams, as the sun rose over the white splendour of the pack, was a sight which made us hesitate to tread on the bejewelled ropes. Arctowski entered the bottom of the barrel first and quickly kicked and pushed out the frost, sending down a cloud of ice which covered my face and sent streams of sharp crystals down my back. We had been in the crow's-nest some minutes surveying the splendour of the widened horizon before we began to talk and discuss the situation. On deck there had been no wind, but here there is a little air coming from all



Eight Successive Phases of an Exhibit of Aurora Australis,
March 19, 1898.

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directions ; now from the south, now from the north, and again from the east or the west. This we regard as a certain sign of an immediate change in the weather. There is also a restlessness in the pack which is an equally certain indication of a change. The water-sky, which we saw yesterday, has extended considerably. The ice is spreading out in some directions, leaving large open lanes of bright blue sea with a metallic lustre. The width of these lanes is from ten to fifty feet, and they extend northerly as far as the eye can reach. Many of these expanses of water offer us a free highway out of our present dilemma. Over the beam, within three hundred yards, there is a river-like stream, but we cannot get to it. In a direction at right angles to these lanes there is considerable pressure. This is shown by the many lines of hummocks raised on the edges of the floes.

We have taken a few pictures of this bird's-eye view of the site (which later proved to be our winter home), but these in black and white are poor illustrations of the pack which is always flooded with curious colours, in unique blends, and soft shades. At this time the sun burst through a torn space in a gathering blackness northward, and sent her beams lightly to the ice, making each pan as luminous as if frosted with a covering of diamonds. The edges of these pans are raised by contact with neighbouring pans. Suspended from these elevations are icicles, and over and under these the ice is charged with yellow sea algæ, making a ring of gold around the gem-strewn floes. In a few places the

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water is covered with a green lacework of new ice, and everywhere there is a delicate suggestion of lilac, raising the high lights, colouring the shadows, and saturating the air with a mysterious luminosity.

Our position at the top of the mast is like that of a bird far up under the heavens. The great ugly-looking, but vigorous, giant petrels are dashing past our heads with an air of inquisitiveness. The little dove-like white petrels come to us almost within reach of our arms, and the graceful brown sea-gulls rush over us and around us with a startling buzz. We are inclined to drift into poetry and philosophy this morning, and everything about encourages this mood. The day, with a temperature -9°C. (15.8°F.), is a delight, and as we look down upon the endless expanse of restless frigid ocean, with its primitive life and death-like silence, we dream of primeval nature. For here is the world nearest to its youthful character. The moving crust of the earth with which we drift, the hardy, simple life, and even the sky, all suggest a period of the earth in its infancy, long before the advent of man. It is this strange simplicity, this other-world air of terrestrial youth, which makes the polar regions so fascinating to nature-loving man. Everything about is new, yet old; every sight is simple, yet clothed in mystery; every phenomenon, like a shy maiden, is attractive but difficult of access. The haste and the bustle of the living world are far from the mental horizon, and the mind is ready to examine the new problems. It is fortunate that one can, after a little experience, here open the book of Nature and record

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the causes and effects of nearly all phenomena, for then the mysterious halo which surrounds everything polar disappears. Each point of attraction which at first bewilders us by its strangeness becomes a written page to be added to the future annals of science. There are a hundred things which, in this way, present new aspects daily and urge the mind out of its lethargy of monotony into a state of fascination. Now we see some peculiar strip on the sky, a striking series of clouds, a rare fog effect, an unusual sunburst, or an aurora; then it is something connected with the sea or its burden, the ice. Perhaps the surface will seem motionless, while at a little distance a small blue-ridged berg will bound and dance as if animated by some strange submarine spirit; or perhaps one of the bergs, with whose face we are familiar, will suddenly turn, offering a new face and a curious colour. Again a berg is seen with black spots and discoloured stratifications. What is the origin of this? Is it the output of a volcano, or is it natural glacial debris? We see the effects, but what are the causes? And so the questions run. Hardly have we learned one lesson when another is brought to our notice. This time, perhaps, it is some speck of life, curiously embedded in a wilderness of ice. What story has it to give? To what family does it belong? We want to know its manner of life, its food, something of its migration, and so on. There is always a stimulus for an endless series of interesting observations. It is these tempting studies which lift the spirits above the even plane of white monotony. It is this fresh interest in the unknown which makes

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life tolerable. We all like to ponder over the days of our youth; those of an inquiring turn of mind love to reflect upon the youthful days of the earth; and looking at the polar world, as a whole, it bears a close relation to what it must have been when man first came to it.

Shortly after noon the thermometer rose, the barometer fell, and the sky assumed a dirty gray. Out of the north came a brisk wind with a steadily increasing force. We have now learned that this is the condition for a storm. The wind increased to a half gale with snow, and continued to blow fiercely all day. At four o'clock we noticed by the squeaking of the ice that a swell was rolling under us. We did not feel its effects about the ship until seven o'clock. Then the ice cracked about us, and was forced together with a pressure which aroused considerable fear regarding the safety of the *Belgica*. Huge hummocks rose on every side, floes were forced over each other, and against the sides of the vessel. The paint was scraped from her, fragments of wood were gouged out of her, and she was thrown over on a floe where she lay taking the thumps and steady pressure with cracks and groans; but the good old ship fought her battle bravely. At about eight o'clock the pressure ceased and the ice separated, leaving small open leads. The *Belgica* settled down again into the water and sought her equilibrium, and, though there was considerable scraping and grinding against our berths later, there was no more pressure. Early in the evening there appeared a strip of blue sky in the north and

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in it appeared the moon, now a small crescent, a mere shadow of the huge ball of red seen a fortnight ago. The sky continued to clear during the night, but the storm increased in force.

March 17.—The storm is still raging; the sky, and even the snow seems black under the inky gloom. The temperature has risen nearly twenty degrees in twenty-four hours, which is a very remarkable phenomenon for the antarctic. The sky in the north-north-east is almost constantly black, indicating what we believe to be open water in that direction. From the ease with which the swell comes in under the pack, and the frequent zones of water-sky, we estimate that we are within fifty miles of the open ice-free ocean; but to reach it is at present impossible. The Commandant and the captain still entertain hopes of getting out, and if our engines were stronger and our efforts to gain freedom were more prolonged we might. The majority, however, are now resigned to the fate of a year on a field of drifting ice, though Gerlache still talks of going to Buenos Aires, and Lecointe discusses a long list of needful things which he wishes to purchase for the next campaign. The days are growing rapidly shorter and the nights, only too noticeably longer. The nights have not now that white glow which they had a few weeks ago. It is this discouraging veil of blackness, falling over the sparkling whiteness of earlier nights, which sends a vein of despair running through our souls.

March 18. — The storm persists with its hellish howl, but the wind is veering easterly. The tem-

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perature remains near zero and this, with the saturation of the atmosphere and almost continuous fall of snow, makes everything about wet and slushy. The decks are covered with a mixture of wet snow and soot and heterogeneous masses of wood. The surface of the pack is wet and the snow on it is soaked with water. We cannot travel on it without snowshoes, and we cannot use snowshoes because the snow adheres to the wood. We must in consequence remain on board in our cabins and listen to the maddening howl of the tempest, as it plays on the ropes and masts and deck over us. Nothing could be more uncomfortable than this thaw coming, as it does, while the winter is well advanced. We are now prepared for cold weather. Steady low temperatures would be our delight, but these wet, warm days bring out a grunt and a complaint from everybody, and when a wet snow-charged tempest drives the slush into our faces and through every break in our clothing, as we make the necessary observations, the situation becomes befitting to the sulphureous epithets which one hears from stem to stern.

About a week ago we killed a seal. The skin and blubber were removed, but the balance of the carcass was left on the floe, about one hundred yards westward. This carcass has attracted great numbers of giant petrels. All the birds about except the penguins are scavengers, but the giant petrel is the king of all. We have had an excellent opportunity for the past few days to study these ugly creatures. In size they are about as large as a goose, but

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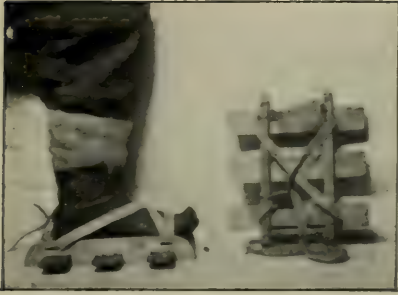
the spread of wing is greater and the body smaller. Their usual colour is sooty-brown with a grayish head. There is, however, considerable difference in colour; for they range from fawn to chocolate, and from black to a silvery gray; occasionally one sees an albino, and also some white, spotted with black feathers. In habits they are gluttons. Many of these about us now have eaten so much that they are unable to rise into the air, but sit on the ice with head and feet tucked into their rough, bushy feathers. If we approach them they run along a few hundred feet and then, if we persist in the chase, the birds vomit great quantities, after which they rise into the air and hover above us in a threatening manner. When we first entered the pack we thought, as did Captain Cook and other early navigators, that these huge, coarse, and ugly petrels were indicative of a nearness to land, but we have now abandoned this idea. The giant petrel is a pack animal, and seemingly prefers the pack-edge, where it can fish in the open leads and light upon the carcass of an occasional seal or penguin. We learned to like this bird for its noticeable, uncouth ugliness. It was, indeed, our most constant companion during the twelve long months following, while we were frozen to a piece of drifting ice.

March 19. — The tempest still continues, but it is coming from the north in doleful wails, like the moans of a dying soul, which indicate that its force is nearly spent. The low, gray sky, the dead white of the ice, and the general monotone of neutral colours is still our cheerless outlook. We are

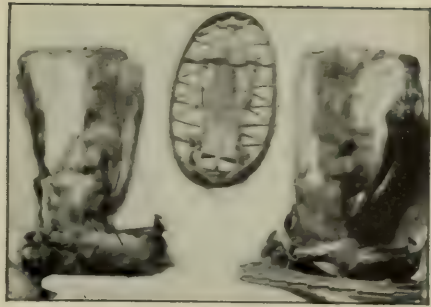
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indescribably tired of these seemingly ceaseless storms. It is not possible to work outside, and interior occupations fatigue us so much that we soon weary of regular work.

5 P. M.—The storm has at last abated. It has left us so suddenly that the calm is as unexpected as it is appreciated. The barometer is steady and the temperature is falling fast. It is already -9°C. , and is still falling. The scene now before us is full of new delights. The ice is spread out again, bright, soft and tinted with delicate colours. Every time the thick air and the gloomy clouds of storm are brushed away, the pack, white and sparkling, has a new story to tell. It brings to us moods like a cheerful page in a sad story. Under the influence of this spell everybody is singing, whistling, and humming familiar tunes; all are planning new work and nursing big ambitions. In the cabin the music-boxes are grinding out favourite music, which rings over the pack with a new joy. In the forecastle the men are dancing and playing the accordion with telling effect. From some invisible point of the pack there comes a weird response to every discord of the music. It is the *gha-a-ah*, *gha-a-ah* of the penguins. We have had a peep at the sun and this has brought about an intoxication akin to alcoholic stimulation, and well it might, for the brief period of its visibility has been a dream of charms. The great twilight zone of purple fringed with violet and orange and rose is rising over the east. The zenith is pale blue studded with a few scarlet and lavender clouds, and the sun, a great ball of old gold, is sinking under



2



6



1

1. The American Lumberman's Boot.
2. The Norwegian Farmer's Snow-shoe.
3. A Norwegian "Truge," a Snow-shoe made of Reeds, and the "Kömager," a Boot made of Soft Leather.



5

4. Boot and Sock made of Penguin Skins.
5. The "Lauparsko" with *Ski* Attachment.
6. The "Finesco," a Finnish Reindeer Skin Boot, and the Alpine Disc Snow-shoes.
7. The Eskimo "Kamik."
8. The Belgian Wooden Shoe.



3



7



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8

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the pearly rose-tinged line of the endless expanse of ice.

8 P. M.—The ice shows signs of strong pressure from the north. Along the crevasses, running easterly and westerly there are great lines of hummocks from four to eight feet in height. The colours of the pack are now far from the despairing monotone of yesterday. The yellow sea algæ have already fixed themselves in the new ice and make it appear ocherous. The twilight on clear nights is extended by the latent luminosity of the snow. The blueness of the pack in this twilight, separated by the ebony lanes of open water and decorated by the algæ-strewn yellow and green lines in the hummocks, make the scenes curiously attractive. Added to this we have the bergs, tall, sharp, and imposing, standing out against the soft blue of the sky and the hard blue of the pack as if cut from huge masses of alabaster. The whole scene is one of lively contrasts, pleasing to the eye and stimulating to the mind, having quite the reverse of the effect of the days of darkness and depressing storms which have preceded.

At about ten o'clock we saw a second aurora. It began as a ragged arc, spread easterly and westerly across the southern sky with a straight line running under it close to the horizon. The space under the arc was noticeably darker than the surrounding sky, and in this space, also in a straight line, were four luminous spots. The colour of the aurora was a bright cream with an occasional suggestion of pink. There was no noticeable reflection of light on the

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snow. There was a quick and constant transformation in the form of the phenomenon. A wave of light ran through the luminous bands and spots from east to west. Some parts brightened and enlarged, others darkened and faded away. The arcs were generally of a steady rayless brightness; the apparent movement and wavy effect of light was in a series of sharp rays on a film-like display before the arc. I found it difficult in the low temperature to remain outside for periods sufficiently prolonged to catch the minute changes in force and character, but I made a series of eight sketches at intervals of about twenty minutes apart, which illustrate the most striking changes. The second form was a homogeneous arc with a fragment of a second arc under it. This hung for some time with a steady nebulous glow between it and the one previous, as well as between the intervening periods of all. The following typical forms then were rapid and almost imperceptible gradations. The third sketch represents the same primary arc always of the same size and in the same position on the heavens: but under it are portions of two other arcs and a suggestion of a luminous horizontal line. At times a wave of rays, converging to the pole of the circle described, ran over the main arc. In the fourth sketch there are two arcs and a portion of a third which were seen persistently in all the exhibits to the present. In the fifth there is a second arc crossing the first. This was suggested in the third and it reappeared in the seventh. The sixth form was an arc with three ribbons of luminous beams waving from side to side. The exhibit ended with a plain arc aglow with a steady light.

CHAPTER XVII

THE FADING DAYS OF THE AUTUMN

MARCH 20.— Although the wind which has swept the pack for the past few days has entirely subsided, the temperature has not fallen as low as we had expected. The thermometer has registered to -15° C. (5° F.) during the night, and is about -9° C. (15.8° F.) to-day. After these storms we usually have a few days of calm weather with a low temperature, and after each successive blow we find that the mercury settles closer and closer to the bulb. We are expecting every morning to find the quicksilver frozen. This is a cloudless day with a sharp sun and a blinding glitter. The topography about has changed much under the influence of the drift-snow during the last storm. About the ship there are huge drifts of snow which make it difficult to disembark. The old hummocks are reduced to little rounded hills, the small crevasses are filled with new ice and snow, and the entire pack of restless floes near the bark seems more like one homogeneous mass. Everything is restful and motionless, and covered with the white silence of death. We, of the scientific staff, have taken advantage of this promise of ice stability to

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make short excursions over the ice to the neighbouring bergs, and to interesting spots in the surrounding regions that we might better study the life and the upbuilding of the sea of ice in which we are fated to be kicked about, until the thaw of another year may set us free. The snow is sheeted with a hard crust, as it usually is after a storm, but we find it unsafe to travel even short distances without snowshoes. The depth of snow is such, and the crevasses are so numerous, that the small bearing surface of the foot is likely to permit us to sink down out of sight.

For these journeys, when a quick unencumbered march is intended, we all prefer the Norwegian *ski*, but when it is necessary to ascend slopes, to cross rough ice, or to pull sledges, the *ski* is decidedly inferior to Indian or to Alpine snowshoes. Our *skis* are mostly nine feet long; with these on our feet we skate leisurely over the rough uneven surface at the rate of about three miles per hour. Over the snow-covered old ice the work is not difficult, but when we come to new ice recently formed, we find the surface as difficult for gliding purposes as rubber. To cross these it is generally necessary to remove the *ski* and walk. It was a matter of some surprise to see the large number and the great width of these strips of new ice which indicate the expansion of the pack. At a distance of five miles we found ten leads with an average width of a thousand feet. This gives an expansion of two miles as a result of the last storm. Ten days ago we went over this same path to a

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favourite iceberg which has been named "Sweet-heart." We then found the distance less than three miles; to-day the journey was nearly twice as long. If the pack increases at this rate what will be its limit at the end of the coming winter night? We saw only one small and two royal penguins, one giant petrel, and a few white petrels. There were no open spaces of water, hence seals and whales and penguins have departed for more open regions in the pack farther north. The penguins we saw were stragglers who failed to go to more congenial regions before the new ice formed; they remain near icebergs where they are sure to find new crevasses in the next few days, and to be deprived of food and water for a few days does not seem to seriously disturb a penguin. About the bergs we found some small holes through the new ice, out of which there came a puff of vapour with a hiss at regular intervals. These were the breathing holes of the crab-eating seals who, like the stranded penguins, await a change in the movement of the ice when new crevasses with open spaces of water will again appear.

The icebergs seem to be the great disturbing element in the movement of the sea-ice. We have several times thought that they were propelled by some contrary under-current, but the extended observations we have made to the present prove quite another fact. We know that the pack, as a whole, is extremely sensitive to the force of the wind; it easily and quickly takes the direction of winds of even mild force. When this wind is long continued

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there is a line of pressure ridges at right angles to the direction of the wind, and lanes of open water in line with the wind, indicating a tendency of the ice to separate in the way of least resistance, which is always north. The bergs always have an apparent movement diametrically opposite to the movement of the pack. This is indicated by a number of hummocks and pressure ridges to the windward, and the usual open lakes to the leeward of each iceberg. While it is thus proven that the berg passes through the sea-ice in a direction opposite to the force of the wind, the nautical observations prove that the entire mass, icebergs and sea-ice, move with the wind with a speed depending upon the resistance, the force, and the direction of the wind. Under ordinary conditions an iceberg sinks seven-eighths of its mass under water. A berg two hundred feet above water therefore has a base fourteen hundred feet under water. The force of the wind expended upon the two hundred feet above is extremely small compared to the enormous resistance offered by the fourteen hundred feet under water. The conclusion must be that the berg seems to move against the wind because of its greater resistance; but in reality it, like the sea-ice, is also carried along by the wind and forced on by the greater speed floe-ice.

March 21.—It is a dull, gray day. The sky is low, with a high fog, but along the south and east there are breaks in the clouds permitting a few rays to steal a passage to the cold, white world below. The night was bright early in the evening with a few auroras, cloud-like fissures, or luminous patches

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in the south-west, but they were of short duration. After midnight the heavens assumed the dullness which now makes the scene one of deep gloom. It is on such days that we assume a disgusted and fault-finding mood. To-day we are dissatisfied with the food. We have complained intermittently for a long time, but now everybody seems bent on having his say as to the badness of our provisions. We have tried penguins and cormorants, but the majority have voted them unpalatable. The excitement, heretofore, of new discoveries and new sights to infuse fresh life has been too frequent and too long continued to permit us to think of dainty foods and tempting relishes. Now it is different. We are held by the increasing grip of the too affectionate pack. We are imprisoned in an endless sea of ice, and find our horizon monotonous. We have told all the tales, real and imaginative, to which we are equal. Time weighs heavily upon us as the darkness slowly advances. The despairing storms and the increasing cold call for some new fuel to keep the lowering fires of our bodies ablaze.

I have taken the trouble to make a personal canvass of every man of the *Belgica* to-day to find out the greatest complaints and the greatest longings of each. The result of this inquiry was certainly a lesson in curious human fancies. In the cabin the foremost wants are for home news and feminine society. We are hungry for letters from mothers, sisters, and other men's sisters, and what would we not give for a peep at a pretty woman? Racovitza reminds us daily that he will write a book describing life in the

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"Ladyless south," and we have all agreed to contribute articles to a forthcoming paper in which we shall advertise our wants. This paper will take the generic name given us by the naturalist, "The Pack Loafers' World." In the forecabin the men are less sentimental and less inclined to poetry. They desire first some substantials for the stomach. Fresh food, such as beefsteaks, vegetables, and fruits are their foremost wants. Two or three, in lone dark corners and in tears, slyly admit that a few moments with the girls of their hearts would be more to their liking. They would like fresh foods, but they long for freedom from the lonely pack, and the congeniality of a land of feminine charms. Our hatred is all heaped upon one class of men. They are the inventors and manufacturers of the various kinds of canned and preserved meats. Our general name for "embalmed beef" is "Kydbolla." If these meat-packers could be found anywhere within reach they would become food for the giant petrels very quickly. In this one sentiment we are all of one accord. Down with "embalmed beef" and everybody associated with it!

I must hasten to say that our food is not without variety, its quality is good, and it is perhaps all that could be desired under the circumstances; but men in the monotone of polar regions develop flighty longings. We have for breakfast cereals, such as corn meal, crushed oats, hominy, good, freshly-baked biscuits, oleomargarine, marmalade, and coffee. Our supply of sugar is low and the provision of milk is almost exhausted. It is the sugar and milk which



Belgica Mittens.



Samples of Darnings.

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are in greatest demand. For dinner we have soups of various kinds, canned meats, preserves, potatoes and macaroni, with a dessert of fruit pudding. Our supper consists of fish, cheese, and an occasional conglomerate mixture of macaroni, nuckles, pemmican, and tinned meats. There is a sufficient variety to prevent a dislike for any one article. There are, however, a few things to which many have developed a sharp animosity. These are usually the articles with a neutral flavour. The things hated most violently are kydbolla and fiskabolla; both are Norwegian concoctions of doubtful stuffs. The kydbolla is said to be a mixture of ground beef and cream, and the fiskabolla is described as a compound of fish and cream. We are, however, ungrateful enough to doubt the usual truthfulness of our Norse friends. The colour and consistency of the meats and fish balls are such that no suggestion as to the composition is possible, and thus one idea after another is developed. Some prove by a plausible argument that they are the refuse of the packing-house, defibrinated, bleached, ground, and compressed. Others insist that useless dogs, cats, and what not, have been utilised. All traces by which one might discover the composition have been removed; even the odour of the fish has been destroyed in the fish balls.

It is in this spirit that we have begun to eat penguin meat. The doubtful recommendation which it has received from other explorers has caused us to shun it; but now, for variety, we would gladly take to anything; even horse meat would be a relish. For some time a few of us have insisted

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upon collecting and saving all the penguins possible, both for the skins and fresh meat. We have tried the meat several times, and it seems to improve upon acquaintance. It was amusing to watch the first trials: little pieces were taken and tasted, and allowed to settle into the stomach slowly. With a few some time elapsed before a second trial was attempted. Some never ventured farther, and others passed their plates for a second and third helping. No one seemed to eat the penguin steaks with any kind of relish, but somehow we stored away quite a little stack of it. It is rather difficult to describe its taste and appearance; we have absolutely no meat with which to compare it. The penguin, as an animal, seems to be made up of an equal proportion of mammal, fish, and fowl. If it is possible to imagine a piece of beef, an odoriferous codfish, and a canvas-back duck, roasted in a pot, with blood and cod-liver oil for sauce, the illustration will be complete.

March 22.—The storm continued through the night and subsided this morning at sunrise, but began again at 3 P.M., and now at 5 P.M. it is blowing a full gale with snow, and a temperature -1.5° C. (29.3° F.). The effect of the wind and the drift has made little change upon the pack in general, but the *Belgica* is being more and more buried in the accumulating banks. The last wind drove us south nineteen miles, and west twenty-six miles, and this storm, being from about the same direction, will undoubtedly drive us still farther into the frigid unknown.

March 23.—The day dawned under a clear sky with a little wind coming from the south-east. The

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temperature is -11.5°C . (11.3°F). There is no marked change in the ice except that the hard sharp edges and projections have been reduced, and the entire pack has assumed a soft, velvety-like mantle which is due to the enormous quantity of drift-snow which comes with the strong easterly and north-easterly winds. At about nine o'clock we saw a mirage, a cream-coloured ridge of ice apparently raised thirty or forty feet above the general surface of the pack. After dinner, accompanied by Lecointe, we took a journey on *ski* for recreation. We chose a course due south and travelled about two miles. The ice was rough, full of small hummocks and crevasses, and altogether very difficult for travelling, but it gave us just the hard physical task which we desired for exercise. At the end of our journey we found a large lead partly covered with new ice. Its direction was south-east and its width about fifty feet. It was a beautiful river-like band of sparkling, blue water which would have afforded the bark an easy passage homeward or poleward, but there were two miles of hard unbroken ice between it and this promising highway. To each side of the lead were a number of small penguins sunning themselves, arranging and oiling their feathers for a plunge into the waters. In the lead in several places we saw a few black spots which, upon closer examination, proved to be groups of penguins coming up from the depths of the ocean to breathe and to sport on the surface after having had a full meal of shrimps. On the return some of these penguins followed us to the ship and were captured by the hunters after considerable difficulty.

March 24.—There were a few faint, luminous

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patches of aurora last night, but the exhibit was so weak that, had it not been in the usual position of auroras, it would have passed unrecognised. The day is dull and gloomy. The morning was somewhat bright and cheerful, but the wind has veered to the north-west, and at three o'clock it increased to a howling gale with snow and a sky sheeted with lead. The barometer is falling with a quiver which seems to indicate an increase and prolongation of the storm. There is much movement in the ice; new fractures are visible, and from the south to the east there is a water-sky, probably indicating a large lake of open water. One giant petrel was the only life seen to-day. A few minutes before six, while the storm still raged, a strip of the sky in the west brightened, and over it the sun, brushed by snow-charged winds, sank to her rest. It is now so dark in the cabin at seven o'clock that we must use a light during supper.

March 25.—The storm continued all night, but stopped suddenly soon after sunrise. The morning gave no promise of better weather. The sky remained low, the atmosphere wet and uncomfortable. After noon a southerly wind cleared the sky and the air, and sent the thermometer falling rapidly. The ice is separating, leaving large, open, endless leads running north-west and south-east; any one of these leads offers us an excellent passage out of this unearthly sea of ice. There is one within two hundred yards of the bow, but this might as well be ten miles off, for we cannot get the vessel to it. We have made some journeys along these leads,

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but have seen only one giant and two snow petrels. The captain's observation at noon shows that we have drifted eleven miles northward. We have made a sounding to-day, and are beginning to prepare the *Belgica* for her long sleep through the coming winter darkness.

March 26.—A white day, with a blinding glitter from the ice. An ice-edge southerly wind is keeping the temperature close to -20° C. (-4° F.). In our excursions to-day, we found the leads of yesterday converted into large lakes partly covered by quickly-forming new ice, which was about an inch thick and covered by a decoration of hoar-frost in large crystals. In the centre of these lakes there were small pools of open water, and in these several families of small penguins were darting like sunbeams through the water to keep from freezing to the new ice. The shores of these lakes and the broad sheets of ice, which spread out over the glassy blue water, were covered, decorated, and bejewelled by a garden-like growth of ice-flowers. In the absence of budding plants we take very kindly to these crystal shrubs. It is remarkable how much real pleasure we find in our admiration for apparently insignificant things. The forms of the hummocks, the figures of the drift-snow, and the clusters of glittering ice crystals, displayed everywhere, are a source of never-ceasing entertainment. The most remarkable of these formations are what we have affectionately styled ice-flowers. In reality, they are snow crystals, so assembled as to form clusters, which are arranged in rows on the new ice. These ice-flowers possess the

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charm of both jewels and blooming plants. In form they are flowers, in texture they are gems. They bud, if I may so express it, with the first sharp breath of winter, casting their fragile tendrils into a hundred delicate forms wherever a suspicion of humidity can be hardened with sufficient regularity and force. Upon porous young ice, adjacent to open water, is the garden spot for these curious growths. They give the finishing touch of harmony to the rough outline of the frowning cliffs of ice. They gleam from the miniature ice mountains. They appear as sparkling flowers upon the black sheets of young ice, and convert the cold monotony of the pack into a glistening field of beauty.

March 27.—During the night we had a striking auroral display. It began shortly after eight as a luminous patch, seemingly a part of an arc. This brightened and faded, and at nine it disappeared entirely. A half-hour later a complete arc was visible with a ragged patch of a second arc under it. At ten o'clock bunches of rays converging towards a common centre alternately brightened and faded over the steady luminosity of the arc. This gave the phenomenon an appearance of movement. At eleven o'clock the aurora was very bright and the sky under it seemed much darker. Later the fantastic displays settled into a plain white arc, with a steadily fading glow.

The wind this morning is still light and southerly. The sky has a brisk wintry look—a quivering high pale blue, lined by a few orange-tinged and violet alto-stratus clouds near the horizon, which seem to

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be placed there for the express purpose of striking a contrast and a line of division between the azure of the heavens, and the blue of the surface snows. The ice has separated much northward and westward. The leads running south-west and north-east have a general breadth of sixty feet and are mostly covered by a green sheet of new ice. Nearly everybody is out on *ski* for recreation to-day. Some are on hunting excursions, others are visiting icebergs for toboggan and *ski* sports, but all are trying to have a royal good time, as they generally do on Sundays when the weather will permit.

Gerlache, Danco, and I went on a long journey due north to examine the ice and, if possible, visit a huge tabular iceberg which we estimated was eight or nine miles away. We found the ice very much crevassed, but there was everywhere a tendency for the floes to unite and assemble into a larger conglomerate sheet, which we call a field because from one edge we cannot see its termination. The snow was hard and fairly even, making excellent *ski* travelling except at the pressure angles where the fields pommelled each other, raising rough uneven ridges. Most of the leads were covered with new ice sufficiently strong to bear our weights on *skis*. We saw little life. There were many penguin tracks on the snow with a general northerly direction, from which we concluded that the little creatures with good sense had migrated northward. We saw also some blow-holes of seals, but no life except a few snow petrels. The whole white world about us was deserted. The berg was a much greater distance

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from the ship than we had estimated, for after we had wandered over the ice six miles the great wall seemed as far away as ever. We should have continued our journey, but Danco found himself unable to follow because of "shortness of breath." At the limit of our journey, looking north-westerly, we saw a series of low yellow clouds, and under these a vague, irregular outline which had the appearance of land.

On our way back we were discussing the matter of raising flags and the formality of taking possession of newly discovered lands. The conclusion at which we arrived was, that the first chart of a new country was quite as good a deed to the title of land, as the empty formality of pinning a bit of bunting to a temporary post and drinking to the health of the Royal Ruler, as is the custom of British explorers. Thus far we have not unfurled a flag, nor have we made any other effort to take formal possession of the many new lands which we have discovered, except by our attempts at scientific exploration. This is in sharp contrast to the British, German and Russian, and all the ancient explorers whose first act always was to land and say, "This by the help of God, the consent of the Pope, and the permission of the King, belongs to us and to our countrymen." The modesty of the Belgians is shown by the fact that the staff of the *Belgica* went ashore to gather, not financial returns, or titles to unclaimed lands, but links of truth to add to the disconnected chain which is to bind the growing annals of terrestrial knowledge.



Whale Blow-hole.



Seal Blow-hole.

CHAPTER XVIII

THE AUTUMN (CONTINUED). WORK AND PASTIME

MARCH 28.—It is another day of clear, white silence. At sunrise and at sunset the twilight zone is becoming more and more marked. It is, to-night, an intense purple blue, and through it we see a star. Arctowski puts down the mysterious purple as a reflection from the shadows of the pack-ice, which at this time is a deep ultramarine blue, but to most of us it is still a puzzle. We are all occupied to-day preparing for a winter campaign of work. Danco is building a triangular hut in which he expects to make his magnetic observations. Arctowski is arranging a new system for meteorological observations and is scattering his instruments over the ice, about the ship, and in the masts. Racovitza is studying bird and seal parasites, and everybody else is preparing for his own special line of work. We all have big ambitions, but I fear our efforts will be dwarfed when the gloomy, dayless night settles down over us.

March 29.—A light northerly wind has lowered, and darkened the heavens, and brought over us a

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wet, warm, uncomfortable atmosphere, with an occasional fall of snow. The snow on the pack is made adhesive by the water-charged air which is being blown over the ice from the open sea now, perhaps, one hundred miles northward. The *ski* will not slide and sledges can be drawn only with great difficulty. The ice is still spreading out, increasing the width of the leads, while the temperature, which is close to zero, is not low enough to make new ice. Life has again returned in abundance. We saw four finback whales spouting, blowing, and sporting, and moving leisurely southward in the leads. We saw also many white and giant petrels, and great numbers of royal and small pack penguins. On a floe about three miles from the ship we encountered six crab-eating seals. We killed all of these and found their stomachs distended by a fresh meal of shrimp. Two were pregnant, and from these the naturalist secured embryos which were, indeed, rare and beautiful. These were placed in a jar and marked for future study. As the sun settled under the horizon westward, a lemon colour spread along the sky in that direction and early in the night the sky cleared somewhat. There was a small feeble fragment of an arc aurora hanging in the southwest with a steady glow during most of the night.

March 30.—The morning opened bright and cloudless with a temperature—20° C., and a gentle southerly air which has brushed away the heavy humid air of yesterday. Racovitza and I went to a lead which Koren, the cabin-boy, visited yesterday, and who reported thousands of penguins and hun-

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dreds of seals. The distance was about two miles and the travelling on the floes was good, but when it was necessary to cross old breaks over the hummocks, and crushed ice, it became a task of considerable difficulty. When we reached the lead we found that what Koren had said was to some extent true. Upon a large hummocky floe in the lead there was much life. We counted twenty crab-eating seals and seventeen king penguins. This was certainly the largest assemblage of the great penguins and seals which we had seen on the pack. With a rifle Racovitza shot six seals and with my *ski* stick I killed all the penguins. We realised the fact that it was cruel to do this, but the calls of science and the dire needs of our stomachs made the deed absolutely necessary. The seals were all females and from them we obtained four embryos. The penguins were bagged for food. Later in the day a westerly wind raised the temperature and brought great quantities of drift-snow. During the night the wind increased to a half-gale.

March 31. — The wind has veered to the north and is still coming with the force of a half-gale. There are great drifts of snow lined about the bark and over the pack. The temperature is -2° C. Everything is wet and far more uncomfortable than it is when the thermometer is at -20° . The captain and Amundsen have brought aboard two small live penguins and turned them over to Racovitza for physiological experiments. We find it very difficult to bring in our game. It takes the full force of three men to drag the skin and blubber of one seal,

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weighing perhaps two hundred and fifty pounds. One man cannot drag more than two royal penguins on a sledge when the snow is either extremely dry or slightly humid, as it has been for the past few weeks, but if the penguins are bunched and dragged on their own feathers without a sledge, a man is able to draw six with ease. The lesson which we have learned from this experience is that sledges, if possible, should be shod with a strip of penguin skin with feathers attached. We are designing such a sledge to-day. It is certainly the first effort of the kind on record and we hope it will prove useful.

April 1. — The storm still continues and the barometer is steadily falling, but the wind is coming in gusts, which is a cheerful indication that its force is nearly spent. The one food upon which the most unlimited hatred has been heaped is the *fiskabolla*. The cook serves these on Fridays, and the coarse sarcasm brought out before and after dinner is certainly remarkable. In the cabin only two men, Gerlache and Amundsen, eat the soft, tasteless, fiberless, and useless things, and they seem to put them away with a grim relish. Lecointe has touched them but once since crossing the Atlantic from Madeira to Rio. Two weeks ago he made a bet with Racovitza, which was supported by a resolution to eat four *fiskabolla*. Lecointe lost and selected April first on which to pay his forfeit. Poor fellow! I believe he would rather have paid a hundred dollars. He ate the things, but he suffered with gastric discomfort for a week, and resolved forever afterwards never to touch, taste, or smell "embalmed fish-balls."

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April 2. — The storm has ceased, and a lighter wind is coming from the south-west. The sky is fairly clear at the zenith, but a bank of atmosphere, charged with fine ice crystals, hangs over the pack and makes the horizon obscure. The sun and the moon, rising and descending through this haze of ice, are distorted, refracted, and deflected, into all sorts of curious fantastic shapes. To-night there was a parhelion in prismatic colours. There was a simple reproduction of the image of the sun, one to each side, and the three suns sank slowly under the hazy violet of the horizon. Soon after, the moon rose through the same haze of floating ice crystals, with luminous spots indicating crescentic rings and four distant moon dogs.

April 3.—The same haze of suspended ice crystals is being driven over the pack, filling up the chasms and rounding all the sharp edges of the hummocks. The temperature is -22° C. and the wind is due south, sending the ice-laden clouds over the crusted snow with a metallic ring. As the sun rose through this mist this morning we saw a variety of parhelia, with bright crescentic patches, changing rapidly in brilliancy and form as the sun ascended. At four in the afternoon the moon rose again through this icy mist. In colour and form it was the most remarkable lunar aspect I ever saw. First, as it came over the horizon, its size seemed so much above what we were accustomed to that we did not easily guess it was the moon. After it rose clear of the ice-line it took a wrinkled, distorted form, which in shape and colour resembled an old withered orange.

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April 4.—There has been a great excitement to day — one which has forced a new interest into the usual sameness of the daily dry routine. The wood-work about the pipe of the cabin stove became ignited, and for a few seconds there was a cry of "fire" and a great scramble for water. Amundsen, with admirable presence of mind, drew out the pipe from the deck and then smothered the flames with snow, while the rest of us hustled about for water, which is always scarce on the *Belgica*. The captain was able to get an observation of the sun to-day at noon, from which he fixes our position at latitude $71^{\circ} 22' 15''$, longitude $84^{\circ} 54' 45''$. A sounding was made which proved the depth of the sea 530 metres. Although the sky has been fairly clear, at noon a steady easterly wind was driving over the pack, sending sharp-edged crystals across the ship with a cutting force. The temperature ranges from -17° to -20° C. In the past forty-eight hours we have drifted northward nine miles, and eastward about eight miles. The wind, coming as it does now with a steady blow, will probably send us drifting westward with a rapid pace.

April 5.—The day opened doubtfully, the sky presenting neither a stormy nor a fair aspect. There is no wind, which is a curious condition of things for this region of eternal blasts. The wind of the past few days has rolled up great drifts, which give a charm of form in rounded irregularities to the surface of the icy sea. With the sudden cessation of the wind, there has been considerable pressure

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which has fractured some floes and raised great lines of hummocks along the fissures and old leads. The temperature is steadily falling; to-day it ranges from -18° to -27° C. We saw little of the sun except a crimson burst at its setting, but the moon has had for us a curious attraction. It is full, and rose over the north at half-past three this afternoon. The purple twilight curve at this time was feeble but distinctly visible. The moon rose slowly behind this, and had the appearance of a great, irregular ball of crude gold, but as it rose above the purple and over the usual line of orange-red, which limits the curve, it was a full sharply-cut globe, pale yellow and fresh, as though washed in the polar whiteness. This was at five o'clock. The sun had just sunk under a line of snow flushed by a rich rose colour, and the sky above it, in the west, was fired by a mass of feathery clouds. As the moon ascended, all of this display of vivid colours faded into the blue electric glow, which is seen only over the polar pack. By this light we were able to read ordinary print at eleven o'clock at night. The heavens at this time were so bright that only the stars to the fourth magnitude were visible.

April 6.—Still it blows from the east. There is now and then an intermission for a day, or a part of a day, when the wind turns to the north or the south, but strong easterly winds prevail. The other winds are hardly of sufficient force or duration to set the pack into motion. Parheliæ and paraselenas are now of daily occurrence. This morning at nine o'clock, when the sun was over a bank of drift-snow

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on the horizon, there was first, a halo, then a rapidly-changing series of sun dogs; generally two extra suns, one to each side, and all having perpendicular lines drawn through the centres. The days are fading rapidly, and the nights are lengthening with an alarming quickness. The life, too, is less and less in evidence. We now walk miles over the desolate waste of white expanse without seeing penguins or seals, where only a few days ago we saw great numbers. There are some tracks of animals which have been stranded by the closing of fissures and open spaces of water. The direction of these is generally northward, or towards some large iceberg, where there is usually open water into which the creatures dive to seek a more congenial region northward, where the fissures are sure to be open. We took a *ski* excursion at noon to-day, and travelled over twelve miles without seeing a speck of life.

April 8.—All the leads and open spaces of water seem to have closed, and all the snowy world about us is saddened under the increasing gray of the coming night. Lecointe has put up a box-shaped house in which he intends to make the nautical observations for the year. We of the cabin have all given him a lift at his house-building. The commandant had a hammer and nails; Racovitza had a saw; Arctowski made the plans; Danco acted as general director; Lecointe and I did the horse work of transporting the planks and other material from the ship to the site of the new observatory. We enjoy such little tasks as pastime before and after our regular scientific observations and official duties. It took us one



Iceberg in the Edge of the Pack-ice, About 120 Feet High.



Penguin Tracks.

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day to build the captain's house, but it was inartistic in shape, unstable in its setting, and the wind blew through it, making drafts and an interior atmosphere colder than that of the open expanse outside. We next covered it with tar paper and anchored it by banking and burying the structure under snow. The captain made his first observation in the new house to-night. He sighted two stars, came in, and rather hastily said, "It is splendid," but shortly after I was called upon to attend to two frozen fingers. This is the first result of our newly constructed shelter.

April 9.—It is the birthday of King Leopold, of the Belgians, to-day. The commandant has made it a holiday and ordered a special menu with a liberal supply of wine to the officers and crew. All are expected to celebrate the day in good form. We enjoy these days of rest, recreation, and change from the usual formula of regular work, and we conscientiously point out, far in advance, the legal holidays of all lands and the birthdays of each of the men of the *Belgica*. It is a slow week when we have not succeeded in having at least one day set aside as a period of special feeding, followed by a flow of champagne. "All honor to the King" is the voice of the *Belgica* to-day. His picture is in a prominent place in the dining-room, and his name is on every tongue. If His Majesty could hear the flattering toasts, the words of loyalty and praise, the genuine feeling of good fellowship which now rings over the new world about us, he would feel that we were, one and all, glad citizens of that little land which deserves the

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credit of opening the gates of antarctic darkness and mystery. He would and should know that, though we are from many lands, we are now proud subjects of King Leopold.

That we might better mark the king's birthday and remember it as a period of great rejoicing, and to arouse our sleeping regard for women we have instituted a "beauty contest." Lecointe, Racovitza, and Amundsen, I think, were responsible for the invention. At any rate, anything suggestive of kind, tender, feminine recollections, or of love and poetry, is first championed by one of these gentlemen. It was so in the "beauty contest." For several days they had been electioneering and pointing out the special merits of the women of their choice. The pick has been made from the illustrations of a Paris journal, illustrating women famous for graces of form and manner, and public notoriety. Nearly five hundred pictures were selected, representing all kinds of poses and dress and undress, and anatomical parts of women noted as types of beauty. The result of this concourse is shown in the following official record of the great event:—

ANTARCTIC NIGHT

ANNOUNCEMENT BY

THE MINISTER OF ARTS, FEMININE BEAUTY, AND
PUBLIC WORKS

GRAND CONCOURSE OF BEAUTIFUL WOMEN

ORGANISED IN THE COLD ANTARCTIC, HELD
UNDER THE AUSPICES OF

S. M. ARTOCHO I.—KING OF THE POLAR ZONE

AND

S. A. ROALD, PRINCE OF THE KYODBOLLA

FIRST PART.—TOTAL OF VOTES FOR THE MOST BEAUTIFUL WOMEN.

DESCRIPTION FOR BALLOTING.	FIRST PRIZE.	SECOND PRIZE.	THIRD PRIZE.
I. Poses plastiques	252	217	218
II. Disposition (dreamy, fond of flattery) .	183	326	339
III. Appearance, common	391	323	260
IV. Rosy complexion	306	245	264
V. Irreproachable character	94	88	210
VI. Grace, personified	209	230	319
VII. Elegant appearance (sweet disposition)	47	463	101
VIII. Underclothing	134	180	—
IX. Most artistic poses	274	404	391
X. Sporty girls	208	397	405
XI. Most graceful dancers	288	291	290

PART SECOND.—TOTAL OF VOTES ON THE EXCELLENCE OF SPECIAL PARTS

DESCRIPTION FOR BALLOTING.	FIRST PRIZE.	SECOND PRIZE.	THIRD PRIZE.
I. The most beautiful face	94	479	480
II. Luxuriant hair	308	320	282
III. Flashing eyes	312	88	—
IV. Mouth (Cupid's bow)	309	88	—
V. Shapely hands (tapering fingers) . . .	311	217	191
VI. Arms	212	—	—
VII. Sloping, alabaster shoulders	212	—	—
VIII. Supple waist	218	—	—
IX. Les jambes	209	217	—
X. Feet	211	—	—

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PART THREE. — Each voter must accept the woman who is selected by his companions as most suitable for his welfare, happiness, etc.

Gerlache	94	Danco	282
Melaerts	191	Amundsen	256
Lecointe	209	Racovitza	64
Cook	88	Arctowski	324, 326, 392
		(One not sufficient.)	

PART FOUR. — The umpires will decide which girl will be likely to be preferred by the various "Wandering Willies" of the expedition.

PRIZE OF HONOUR

The prize of honour will be given to the most beautiful woman — the one having obtained the largest number of votes.

GENERAL CONDITIONS

The photographs of the "Beauties" to enter into the contest are filed in the "Minister's" book. There are four hundred and sixty-four (464) pictures, charms, delights and fascinations, but voters are cautioned not to become too enthusiastic or overheated. Those carrying photographs (of favoured ones) in their pockets and pinned to their vests, as nearly as possible to their hearts, may submit them for inspection to the "Minister."

It is hoped that the elections will be honourable, but "all is fair in love and war," and in the "Ladyless South," swindling of all kinds is allowable providing it is in an honourable cause.

DISTRIBUTION OF THE PRIZES

On the arrival of the *Belgica* in port the Minister will send the diploma, drawn by the "King's" own hand, to the fortunate winners of the prizes. The presentation of the prizes is conditional upon the later appearance of the woman before the committee to exhibit the parts for which ballot has been cast, not for re-examination, but to obtain an official photograph.

(Signed)

RACONEVIPADECA, President of the "Pack Loafers."

LECOINTWHISKY, Minister of the Land of Beautiful Women, and "Lady Specialist."

CHAPTER XIX

THE FADING DAYS OF THE AUTUMN

(CONTINUED)

APRIL 10.—Yesterday the wind was from the east and it came with a maddening hiss. To-day it is from the south, still, sharp, and icy. There is a great commotion in the ice. Old leads have again opened and widened, new fissures have formed, and there is a distinct swell noticeable in the steady, regular shift of the ice-floes. About the ship the ice is much crevassed, and less than one hundred yards away there is opening a new lead, which is now forty feet wide. We saw in this lead two finback whales and several seals. Seals and whales have been heard blowing most of the day. While taking a usual evening excursion over the floes I saw, to-night, two distinct fragments of an arc aurora in the south-east. The thing remarkable about this aurora was its colour. It began as two faint, luminous patches, crescentic in form. There was a rapid play of light in these from a pale, pearly glow to a vivid cream color, but the most wonderful of all was the glistening green shade to which it changed for a few seconds just before it disappeared. The same aurora

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reappeared at about half-past eight in the evening, but it was white and dull.

It is Easter Sunday. We have been up most of the night trying to settle the many disputes which have arisen out of the "beauty contest." It is so long since we have seen a girl that I doubt our ability to pass judgment on the charms of beautiful women. On the whole, though, we have not come to any definite conclusions except that the Princess de Chimay and Cleo de Merode are voted by the majority to be the world's most beautiful women. The excitement of the contest has been such that a new life and a new stream of ideas are coming over our frosty spirits. To-day we talk of sweethearts, of sisters, of mothers, and of home. For a time we have forgotten the never ceasing sameness of storm-beaten pack-ice and our uncertain future. Our minds and our hearts are homeward, and it is a good change in the drift of sentiments. We can ill afford to go into the spell of the long, unknowable night with the air of despondency which has fogged our mental energy for the past few weeks. Easter Sunday should bring new joys and the poetry of the budding passions of spring. The artificial hilarity of last night has placed us in an easy mood for a new period of fresh pleasures.

But how different is our lot to that of the usual Easter worshipper! The seasons are here reversed. We have not behind us the winter storms and cold discomforts. We have not before us the evident joys of a coming summer; sweet smelling flowers, green fields, pretty girls in new bonnets, and the hundreds of

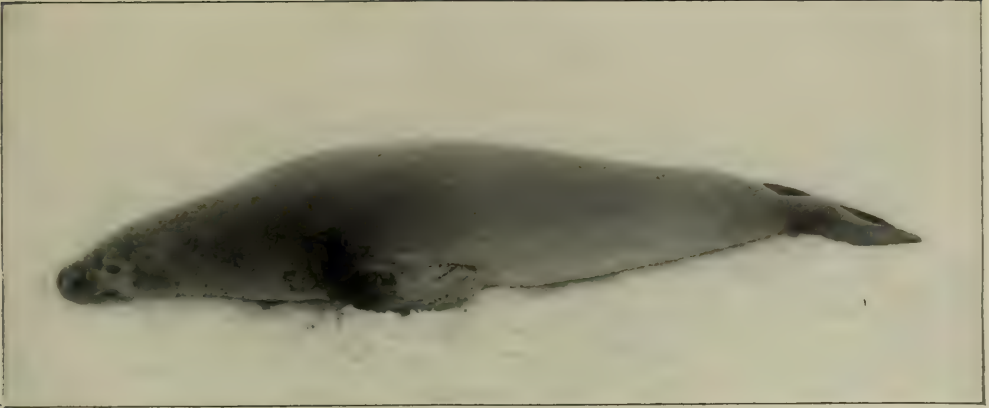
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things which go to make up the accustomed pleasures of Easter are all far removed from us. We are on the verge of what promises to be the worst winter on record. The faint delights of summer are behind. The desperation, the despondency, the mystery of the unknown, impenetrable darkness, with its ceaseless frost, is on the horizon. Hellish storms with icy vapours are almost constantly sweeping over us. There is not a rock or anything suggestive of land within many hundreds of miles, and there is not a tree or flowering plant within thousands of miles. Nearly one-third of the circumference of the globe is between us and our loved ones at home. Under such circumstances, far away from the world of life, isolated from accustomed comforts, on a sea of moving ice, in a dead, white world of eternal frigidity, how can we enjoy Easter? We try hard to arouse a buoyant spirit, and each has taken it upon himself to bring out the bright side of the one nearest to him, but our efforts are poorly rewarded. For after superficial laughter we sink into a lethargy which becomes more and more normal to us as the winter and the night advance. Some one has said we want only our home surroundings, some loving women, fresh food, a few flowers, and our lot will be happy. I believe this, but I also believe it is just these which are all that is required to make Hell agreeable to the average man.

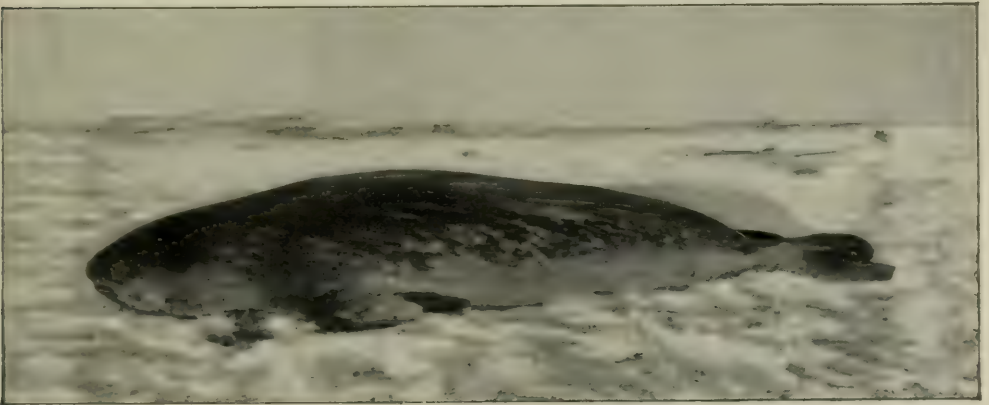
April 11. — The ice is spreading, leaving large open lanes in which we see whales, seals, and penguins. The day is clear with a very light air from the south-west. Four white petrels are about the

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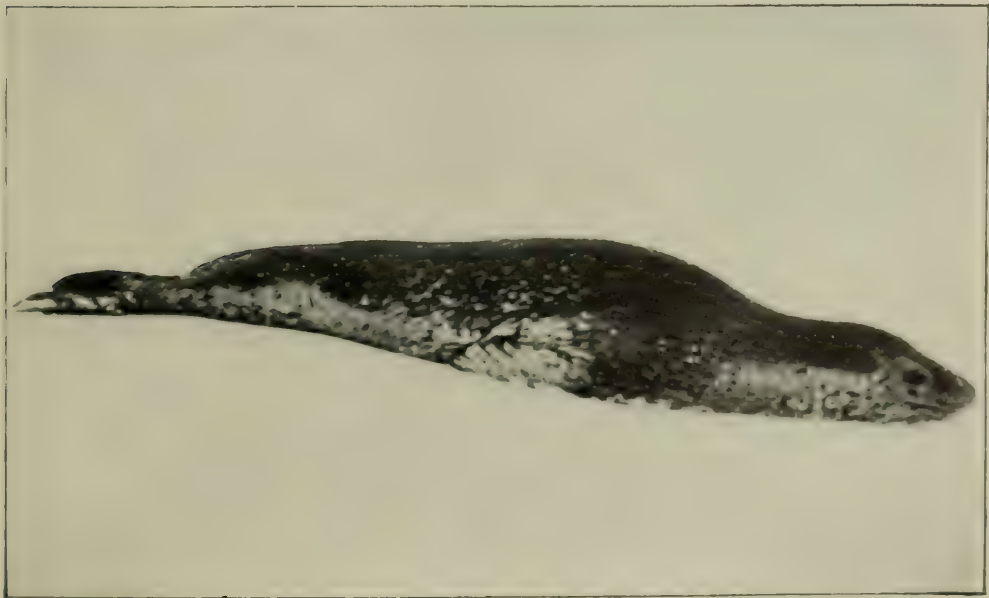
ship, and far out over the leads we observe a few giant, and some spotted brown, or antarctic petrels. Aside from our usual work of making observations, and recording the passing conditions of weather, and life, and ice, we have begun to house the *Belgica*. The sailors have, for a long time, been building a wall of blocks of snow about the bark. The great quantity of drift-snow during the past few weeks has evened this up to the gunwales, but the decks are still too open and permit, unnecessarily, the escape of the heat from our stoves. It will be necessary to economise greatly with fuel, for we have now hardly sufficient to give full steam for fifteen days. The poop remains buried under a bed of snow and ice two feet thick, and most of the windows are being closed because there is already upon the glass too much condensation of frost to permit light to enter. Amidships we are building a shed to permit a sheltered passage from the cabin to the laboratory. This will be covered by snow, and under it the engineer will erect a smith-shop in which to make iron repairs to the *Belgica* and the various articles of equipment. Heretofore it has been difficult to get out because of the great quantities of snow which has buried everything on deck. We hope the new shed will eliminate this misery which almost forbids our disembarkment. We have found it necessary to make double storm doors and double windows to prevent sudden changes in interior temperatures. By experience it has been found that ventilation through small pipes from corners of the rooms is the best. If the windows or doors are opened a volume of cold air rushes in, and



Crab-eater (*Lobodon Carcinophaga*).



Ross-Seal (*Ommatophoca Rossi*).



True Sea-Leopard (*Ogmodon Leptonyx*).

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at once everything is wet from the condensation out of the air by sudden chilling. If I were to sum up in two words the things which in polar regions bring about the greatest amount of suffering, I would say humidity and isolation. We try in every possible way, in the cut of our garments, in the construction of our winter quarters, and in the arrangement of our sleeping apartments to eliminate moisture, but our success is small. If we drop our hands behind our beds a weight of frost falls with a metallic tingle. If the mattress is removed every nail is found to be covered with ice. Both Racovitza and Danco vow that they have icebergs as bedfellows, and when one goes between decks there is always sufficient hoar-frost falling down one's back to keep up a warm volley of words. My room mate frequently opens the port and forgets to close it when the wind changes: consequently we have to shovel a bank of snow out of our beds every second or third day. If we could only get rid of this infernal humidity which plagues and follows us like an agent of Satan, and if we could take a run to a civilised town once monthly so that we might absorb a new train of thoughts, life would be bearable. Certainly the cold is not a cause of serious suffering in the antarctic, for I have shivered more in New York.

April 12.—Snow is falling in huge flakes. The temperature is now rising, but during the night it fell to -23.5° C. The wind is east-north-east. The ice continues to separate, but we have seen no life to-day. We are still at work housing the *Belgica* and fitting the cabins for the long imprisonment. It is warm,

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and dull, and gloomy, making the air on board unendurable. Everything about the decks and the doors is moist, and the coating of hoar-frost, which yesterday made every nail and every bit of iron sparkle, is melting, making the floors, the table, and the chairs uncomfortably wet.

April 14.—The wind has veered to the south-east and is coming with increasing force charged with a dry sand-like snow which cuts the skin like a knife. Temperature, 6 A.M., -8° ; 10 A.M., -19° . We saw two finback whales and one snow petrel. As is always the case when the air is charged with drift snow, we have a variety of sun and moon dogs to-day. At 7 P.M. there was in the south-east an unusual aurora. It was an arc with steady brilliancy, and to the westward were fragments of two additional arcs.

April 15.—To-night we saw an aurora of exactly the same form as last night, in the same position, appearing first at the same hour. The zenith has been clear, but the horizon has been hazed by the suspended ice specular which again made a countless number of sun and moon halos, parheliæ, and paraselenes.

April 16.—In this shiftless sea of ice everything depends upon the wind. If it is south, we have steady, clear, cold weather. If it is north we have a warm, humid air with snow and unsettled weather. If it is east or west it brings a tempest with great quantities of driving snow; but it never ceases blowing. It is blow, blow, from all points of the compass. It is because of this importance of the wind, because

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it is the key-note to the day which follows, that our first question in the morning is "how is the wind?" To-day it is east, and has increased to a gale, in which it is absolutely impossible to take even a short walk on the pack. For recreation we have taken to mending. Racovitza is patching his pantaloons for the tenth time. This, he says, will be the last time, and I think he is right, for he has used leather to strengthen all the weak parts. Amundsen is patching boots; Lecointe is mending instruments; Danco and I are trying to repair watches. Nearly all of our good timepieces are out of commission. Our hands are better adapted for the trade of a blacksmith than that of a jeweller, but we are trying hard and have, to some extent, succeeded. Just at present it is the crystals which we wish to replace. We have no extra glasses, but we have found some small pocket compasses with crystals too small. How can we make them fit? Danco said, "Try sealing wax," which we did. We covered half of the watch and a good part of the crystal and thus made a very effective job, but in appearance it is a woeful object.

April 20.—The easterly storm which has raged unceasingly for a week, and almost continuously for a month, shows some signs this morning of ceasing. At 4 A.M. the barometer began to rise, and the temperature fell to -2° C. The wind shifted to the north-east, but its force was soon spent. During the day the wind came only in intermittent puffs. The mouse-coloured clouds separated, permitting an occasional sunburst to light up the awful gloom which has so long hung over us. To-night, at ten o'clock,

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it is actually calm, and snow is falling lightly in huge, feathery flakes. This sudden calmness and dark unbroken silence, after the many days of boisterous gales, instill within us a curious sensation. The ship no longer quivers and groans. The ropes about the rigging have ceased their discordant music, and the floes do not utter the usual nerve-despairing screams. This sudden stillness, seemingly increased by the falling snow, brings to us a notion of impending danger.

April 21.—The night and the morning continued calm. What a relief to be able to step out upon the open expanse of the frozen sea without being pounded, and battered, and smothered with needle-like ice crystals driven by these damnable storms! We are all out on the pack to-day to get a breath of air in comfort and to see once more the height of the sky and the broadness of the horizon. This polar under-part of the world is decidedly unfit for human life, for it is seemingly the part which receives the kicks of the angered spirits as the globe passes through space. The temperature has fallen from -3° this morning to -17° at eight to-night. The sun has struggled to pierce the heavy cloud of ice crystals which rests on the pack, but its efforts have been rewarded only by prismatic effects. Halos, and parheliæ, and fog-bows have been on the sky most of the day; the warmth of direct beams, however, has not been felt. For two days we had seen no life, but to-day we heard a whale spout, and saw two white petrels.

At noon the sun was visible behind a screen of suspended ice particles. Its edges were barely percep-

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tible, but the captain tried an observation to find our location on this unknown sea. The result of the calculations was latitude $71^{\circ} 03' 18''$. The sun is now extremely unreliable as a fixed point to find our positions. It is so low on the horizon at noon that, owing to the great refraction caused by the increased depth of the atmosphere and the increased refractive quality of the air at this temperature, it is difficult to make the necessary corrections. From this time on, until the sun rises higher next summer, Captain Leconte will use the stars to get positions.

April 22.—During the night there was another fall of snow of about two inches. This morning the sky was dull and gray. The air continues calm, which is remarkable, but because of the unstability of the barometer and the persistent gloominess of the sky we anticipate another storm presently. At noon we felt coming, this time from the north, the first breath of this promised gale. It swept the pack with a blackness and a moisture which are characteristic of northerly winds. The temperature ranges from -6° to -9° C. The ice is in considerable agitation; old leads are closing and new ones are opening, with a direction almost due north. We made a sounding at two o'clock in the afternoon, hoping that the night would be clear enough to permit an observation for position, but the night is cloudy, which makes the work of sounding useless. The captain has figured out the declination of the compass for our position of yesterday and finds it to be $38^{\circ} 37'$ east of north.

April 25.—It has been a charming, clear day, with

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only a few stratus clouds along the horizon, and a light, pearly mist rising in a straight line from the ice. Several times during the day we saw parts of a white rainbow or fog-eater. The photographs which we now take prove that the light is feeble, though seemingly bright. It is quite impossible to make good negatives at the present time. This, I believe, is due not only to the feebleness of the light, but to the glancing direction of the rays, the yellowness of their colour, and the fact that the beams of light strike the snow at such an angle that they glance off into space, and make the atmosphere itself partly luminous, which destroys the plates.

The pack is again apparently at rest; the new leads and lakes are covered with young ice, which is frosted by a beautiful growth of flowery bunches of hoar-frost. These leads, in the present yellow light, have assumed a most intense green colour, and as they wind about the blue ice-walls and the cream-coloured floes the scene becomes entrancing. The temperature this morning was -21° C.; to-night, at nine, it is -27.5° C. There is a feeble arc aurora in the usual position. Its brightness is about like that of the milky-way, and this is the average strength of most antarctic auroras. Our position is daily getting to be of greater interest. This is shown by our attention to the work of the captain and others upon whom we depend to tell us where, in this aimless drift, we are pointing. When Captain Lecointe goes out to "shoot" the stars we await his return with some impatience, and, though he cannot at once give us the exact figures, we are inquisitive to learn quickly

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his guesses at the amount of the latest drift, but he must often stamp and kick, and we must punch and rub him, to start his circulation before he can talk.

An electric signal has been arranged so that Dobrowolski, who assists Lecointe, can remain in a comfortable stateroom with the chronometer to fix the time for the observations. The captain has exhausted every ingenuity to make the work as agreeable as possible, but there seems to be no way to lessen materially his own discomforts while sighting the stars. The observatory is sheltered from the wind, but the air in it is just as cold as that outside. To-night the temperature was almost -28° during the time of the observation. The difficulty of keeping the teeth from chattering, the eyes from quivering, or the instruments from shaking, can be more easily imagined than explained. Danco came in after making his sights with a frosted foot, and with a piece of skin, torn from his eye, frozen to the metal of the eye-piece of his instrument. Lecointe lost some of his eye-lashes, and a bit of his ear was white. Both Danco and Lecointe have resolved to cover the metal parts of all instruments with flannel in the future, and from them we have copied the idea and covered the metallic portions of everything we use for our work outside. It is, however, an almost daily occurrence to have men come to me with fingers "burnt," as they express it, by contact with bits of cold metal. One sailor, who was at work between decks nailing up cases containing geological specimens, placed two nails in his mouth. He snatched them out quickly,

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bringing along bits of his tongue and lip, and leaving ugly wounds which in character were exactly like the injuries of a hot iron. The sailors who have metallic pegs in their boots claim that ice-caps form under their feet. This I have taken as a sailor's yarn, but to-night I went on deck in slippers; on returning my stockings were thoroughly wet,—removing the slippers to discover the source of humidity I saw about a dozen, glistening caps of ice that had formed over nails which had been carelessly driven through the soles. These things seem incredible, but similar instances are repeated daily.

But I have started out to-night to write, not of the little nothings which really do make up the bulk of our work and pastime, but of the more serious drift of the *Belgica*. We are going westerly with a steady and rapid gait, and though we drift frequently northward, our general progress is also at times slowly southward. Where will we be when the thaw of next summer shall set us free? Since the first of March, when our position was latitude $71^{\circ} 04' 45''$, longitude $85^{\circ} 26'$, we have gone a zigzag course westerly, now above the 71 parallel, now below it, but generally west, until at present our situation is latitude $70^{\circ} 50' 15''$, longitude $92^{\circ} 21' 30''$. We have thus, in less than two months drifted westward about seven degrees of longitude. We are curious to know whether this drift will continue, or whether the prevailing winds of the coming winter will send us adrift in another direction. Almost without knowing it, without setting sails, and without



Weddell Sea-Leopards on the Pack-ice.

(Lept nyctotes Weddelli.)

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steam, we have made a snaky course of about five hundred miles over an unknown sea. This is peculiar navigation. We have seen nothing move, there has been no fixed point to indicate our drift, and we cannot see that we pass through the water because the entire horizon, the countless fields and mountains of ice, slide with us at the same rate of speed. We are carried along with the restless pack, slowly but steadily, with majestic ease, against our desires, without seasickness, always on and on in response to the ever furious winds. This is exploring under difficulties because we are absolutely helpless to direct our course, but we hope that the Hand of Nature will guide us to some interesting region.

Our drift has already proven geographical problems of considerable interest. We are now drifting two degrees south of the assigned position of Peter Island, and we have seen no definite signs of land. This proves that the island is not one of an archipelago, extending far south and guarding closely a continental mass of land as might have been supposed. The freedom with which we drift here, and the absence of unusual pressure, warrants the assertion that there is no land of sufficient extent to check the drift of the pack within a hundred miles. We have now sailed with the bergs and the floating crust of the earth over a sea about 500 metres deep, through a region where John Murray has placed a hypothetical continent. Murray's "Antarctica," if it exists, must be reduced in size, for we have sailed over it without finding a projecting rock. We have, in our

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helpless drift, been forced south of Bellingshausen's farthest, and are now headed for Wilke's "appearance of land" and Captain Cook's historic farthest. Perhaps if we were able to direct the vessel we could not more effectually explore these regions. May the elements which have sent us thus far continue to guard and push us forward!



Arctowski and Amundsen ready for a stroll

CHAPTER XX

THE DAYS OF TWILIGHT PRECEDING THE LONG NIGHT

APRIL 26. — The sky is again hazed, the barometer is falling, and the temperature has risen from -21° at 8 A.M. to -2° at 3 P.M. We made a sounding and found the depth 410 metres. During the day Racovitza lowered his paraphernalia to fish submarine life for the laboratory. We had hardly lost the effects of the last storm and were beginning to enjoy the clear steady weather, with the light southerly winds, but to-day there is another storm. The sun burst through the high fog at ten o'clock this morning, but her rays were too feeble to dissolve the cold vapours. Quickly the only bright spot of heavenly glory was smothered by cold leaden clouds coming from the darkness of the north-west. This we knew to be an announcement of the coming of dirty weather from that direction. For five days the barometer has steadily risen, but this morning it began to fall and in this descent we read the story of another week of trouble. Violent winds, in conjunction with the noise, the gloomy darkness, and forbidding exterior conditions, will set up a spirit

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of discontent and melancholy, followed by insomnia and disturbances of digestion. I suppose, however, we should not complain, for these gales carry us along on interesting journeys where no other human eyes have before scanned the horizon.

April 28.—It is a neutral gray day. There is no sun and nothing to arouse an interest in life. The atmosphere is dark, warm, wet, and, in general, most disgusting. The temperature is -1° , but about the ship the snow has melted much, allowing the *Belgica* to settle now and then with a crack and a sudden jar. The wind is westerly and comes with a steady rush. The ice is separating, leaving open leads running north-westerly. We saw several white and two-spotted brown petrels. The trawl, yesterday, brought up a mass of weird-looking deep-sea creatures which Racovitza is to-day stowing away in alcohol. In these storms it is not prudent to venture outside over the pack. There are just now too many large fissures covered by soft snow-bridges which are dangerous. We have already had several cold baths by sliding through these soft drifts, and a fatal accident might easily occur. With these perils in view we do not risk going out on the pack for the usual recreation and exploring excursions. The men, too, find it extremely difficult to keep open a passage to embark. The drift is such that it requires the constant efforts of one and sometimes of two men to dig a path. It is irritating that the drifts are usually a few feet from the side of the bark where they do not give the needed shelter, while the excellent wall of snow which the men have

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placed around is again mostly melted or settled to such an extent that it must all be done again. On board, the naturalist has several mysterious creatures from the bottom of the sea, under the microscope. The geologist is packing away the stones picked from the new land a few months ago. The captain and the commandant are laying out the chart of the discoveries and we are all looking up the bibliography of everything antarctic.

April 30.—It is snowing and blowing still, but the temperature is again falling. It is dark and gloomy and humid outside. We begin to think that the sun, and the moon, and the stars have deserted us, leaving us alone in a cold, howling wilderness. We saw a few white petrels hovering over large lakes of inky waters, which the change in our drift has made from the wide leads of a few days ago, but there is no other life. It is now necessary to light our lamps at three o'clock in the afternoon to do ordinary work about the vessel. I expect it will not be long before it will be necessary to use candles during our midday meal. To-night there is a sign of clearing in the whirling cloud of snow which has driven about us so long. The moon is glowing brightly in an inky sky. It is the first glimpse of a heavenly body in nearly a week. The new moon has partly spent itself above the banks of frosty clouds which, for weeks, have veiled the heavens. To-night it comes to us with a ragged fringe on its upper surface, but we are glad enough to get even that. The moon, like the sun, is sailing along the northern sky from north-east to north-west about 30° above the horizon. There is a bright band

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of green rays running through the moon to the surface snows where the light expands and becomes diffused. Late last night we observed a series of luminous clouds which, from their quick movement, we took to be an aurora. But the position of the moon to-night, together with a similar exhibition of luminous clouds in the same position which we know to be brightened by lunar light, convinces us that we have been mistaken.

By an observation at ten o'clock to-night our position is deduced to be latitude $70^{\circ} 43' 30''$, longitude $90^{\circ} 30' 45''$. It is evident that we have begun to drift rapidly on an easterly course. In five days we have drifted northward seven miles and eastward nearly two degrees. (From this time on, through the long night and far into the advancing day, the trend of our drift was easterly, in response to prevailing westerly winds.)

The months of March and April were, in many respects, the happiest months of the year. Everything at this time was new to us. We found interest in the weird cries of the penguins; we found pleasure and recreation in hunting seals, and we prided ourselves on our ability to wing petrels for specimens. Everything about the new life and the strange, white world around us was fascinating. The weather at this time was occasionally clear and cold, though generally stormy, which was not the case during the greater part of the year. The pieces of ice gathered into groups, and united to form larger fields. The entire pack, one endless expanse of apparently motionless, but still constantly moving, ice, was full

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of interest to us. The sun presented a curious face in its rise and descent; and the colour effects, though not gorgeous, were attractive for their simplicity of shades. The moon, too, had a distorted face as it came out of the frosty mist resting over the pack. The stars shone occasionally through their setting of heavy blue with a sparkle like huge gems. At this season the aurora australis displayed most of its rare glory on the southern skies. We were drifting rapidly from one unknown sea to another still more unknown. "Perhaps we are on the way to the south pole," was an everyday suggestion.

Our first and most important work in the pack was to study the strange sea over which we drifted. This necessitated observations, not only of the sea-ice and icebergs and the scant life about us on the ice and in the water, but also of the composition of the water, its depth, the temperatures at various depths, and the material of the sea-bottom. It required also a careful study of the atmosphere. The heads of the various scientific departments and their assistants were kept busy for a part of the time making these studies. The sailors, in addition to assisting with the scientific labour, were kept well engaged by the ordinary routine work of the ship and the task of embanking the vessel with snow to protect her from the expected cold of the coming winter-long night.

By the end of April our ship was snugly arranged for her winter imprisonment. A roof had been erected over the deck amidships, and under it were an anvil and a fire for the use of the engineer while

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making the necessary iron-work. The cabins were rearranged to offer the greatest possible amount of heat, light, and freedom from humidity. A floor was placed over the engine-room, and on it a small stove to heat the officers' quarters. The galley was put between decks next to the forecastle, into which should go the superfluous heat. Double doors and double windows were made everywhere, and all possible openings where heat might escape were closed. Exteriorly, the sides of the ship were banked by snow blocks, the decks were blanketed by the constantly falling snow, and over it all the snow-charged winds drifted, making a neat and perfect embankment. Our antarctic home, then, was imbedded under a huge snowbank, on a field of ice which drifted with the winds over the unknown antarctic seas.

It was my delight to ascend to the masthead and from the crow's nest view our horizon day by day. The general aspect of our view changed very little. Some new cracks formed in the ice, and old ones closed. Some of the icebergs occasionally turned a little, showing a different face, but no marked alteration was ever visible in the general topography of the pack. Moving about as we were, there always seemed to be a possibility of finding a speck of land, a rock, or something new in our path; but this never happened. We saw no land during the entire drift. Appearances of land were reported every few days, but always proved deceptions. They were only illuminated clouds. Along the edge of the field in which we were frozen were large ridges or pressure lines, where the contact and pressure against neigh-



The Ross Seal with Trachea Inflated.
(*Ommatophoca Rossii*.)

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bouring fields raised fragments of ice above the surface. These ridges were from three to fifteen feet in height. The field, usually about two miles in diameter, was everywhere dotted by pyramidal and dome-shaped miniature mountains, which arose above the surface from two to twenty feet. These are technically called "hummocks." Around the hummocks and along the edge of the floe penguins and seals rested, sheltered from the wind. Near the ship and about the outhouses the snow was thrown up in great banks, dotted by black spots representing sledges, snowshoes, sleighs, and general implements. As we emerged from the little hold on the port side which was our only exit, a narrow path led out about one hundred yards to a circular hole through the ice. Over this we had erected a large tripod, from which we suspended the instruments for sounding and fishing and recording deep-sea temperatures. About midway between this and the ship, we built a box-shaped hut for nautical observations. About one hundred yards from the stern of the ship, Mr. Danco contrived a curiously shaped box for magnetic observations, and a little distance beyond, upon a convenient hummock, were placed the meteorological instruments. About two hundred yards off the port bow, a small house had been put up to capture the electricity from the aurora australis. Efforts were made to keep a path open to each of these houses, but the work generally proved futile. The quantity of drift-snow was always so great that it buried every path and every irregularity in the vessel's vicinity.

It was at no time possible to leave the ship with-

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out snowshoes of some sort. The little exercise on the ice, which freedom from duties permitted, was taken on the Norwegian snowshoe, the *ski*. For mere pleasure-journeys these proved in every way superior to the Canadian rackets and other patterns; but where it became necessary to pull sledges or travel over rough paths, the other kinds were better. We made several long journeys to neighbouring icebergs. Sometimes on these journeys we met with serious obstructions and detentions. It was not found practicable to carry food, extra clothing, or camping equipments, and yet often the need of these became very great. The ice, in separating, would leave large zones of water between us and the next field, thus cutting off our retreat, and leaving us to spend hours of meditation upon the prospect of starvation and of death by freezing.

May 1.—The day is fair with a light south-westerly wind at noon. Low down on the northern sky the sun has been edging along the pack, screened by flying banks of ice crystals, but it has given no perceptible heat and only a feeble light. Hardly had the sun sunk under the sea when a furious westerly gale swept over us, and drove snow into every crack and opening of the *Belgica*. Leads have spread again, and great lakes are pictured on the sky by smoky patches. We secured five small and two king penguins and saw some seals and whales. Life is always abundant when large continuous leads are open. There is so much movement now among the individual flocs, and so much pressure and crushing about the ship that we believe it unsafe to venture out in

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the dark for fear of stepping into one of the many new crevasses. For the same reason we entertain some anxiety regarding the safety of our outhouses and the implements scattered about on the ice. It is curious that we should have such continued warm weather, and equally curious to find the pack breaking up when the days are already far advanced in the antarctic winter. The only explanation for this unexpected condition of things is that we have drifted to a region close to the edge of the pack.

There are many changes in our surroundings which seem to indicate our nearness to open water. There is a noticeable swell which is shown by the alternate advance and retreat of floes about the icebergs, and by a total rise and fall of six inches of the sea-ice on the walls of the icebergs. The time between each rise is from 24 to 32 seconds. The evidence, then, of a wave under the ice is quite conclusive. Just how far beyond the pack edge the swell can be made to penetrate will depend very much upon the size of the floes and the amount of space between them. From our present experience it seems likely that a northerly storm is able to send an undulation at least fifty miles under a loose pack and, perhaps, much farther. But there are other signs of a nearness to an open sea. The floe into which the *Belgica* is frozen is getting noticeably smaller, and all of the other floes are diminishing likewise. There is a great deal of brash, broken blocks, and pulverised ice and snow, in the water. The icebergs turn and move about, changing their relations to each other. New cracks and new leads are daily appearing. The tem-

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perature is rising steadily instead of falling, as it should with the retreat of the sun. The weather is unsteady, and constantly changing, but always in such a way as to indicate a nearness to an open sea. A month ago a storm had little effect upon the ice, but now even light winds bring about a noticeable commotion.

May 4.—At seven o'clock this morning Lecointe rushed out of his bunk to get a glimpse of the stars, which broke through the high mist for a short period. From this observation he calculates our position at latitude $70^{\circ} 33' 30''$, longitude $89^{\circ} 22'$. A sounding made at about the same time gave a depth to the sea of 1150 metres. From this great increase in depth we are still more convinced that we are going to the edge of the pack, and off of the submarine bank over which we have drifted since entering the main body of the ice. In nine days we have drifted about seventeen miles northward, and eastward nearly three degrees. We are going back to the east, and when the veil of darkness rises, we shall perhaps find ourselves near the position where we entered if, in the meantime, we are not forced out of the ice into the open sea. To be compelled to leave the ice at present, much as we should like it, would be quite dangerous. We have almost no daylight; the weather outside of the ice would certainly be stormy and foggy. How could we find our way in the darkness, among the certain dangers of icebergs and unknown rocks, over the storm-swept seas to South America at this time? Since the first the weather has grown colder; the temperature has

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ranged from -5° to -18° C. We have occasional strips of blue sky, with a cold sunburst, but in general the heavens have been cheerless—still it is an agreeable change from the wet, dirty weather which we had before.

May 10.—There are now constant complaints of the warm weather. A few days ago the temperature rose a half of a degree above zero, and it has remained about one degree under zero for several days. Such weather, in the commencement of winter, when steady cold weather is expected, is positively oppressive. Everybody is in a disgruntled spirit, because everything is wet, and there is a never-ceasing howl of the storm. It may seem unnatural that we should hate warm weather in this wilderness of south polar ice, but it is followed by so much discomfort that we are ever praying for steady frigid temperatures. In this warm weather the ice is becoming more and more broken. Seals and whales are sporting in the open channels, but penguins are rarely seen. There are a few giant and brown petrels about, and great numbers of white petrels. We have killed a few seals, and have removed from them their skins and blubber for future use, but we have left the remainder of the carcasses out on the floes. These have been claimed as prizes by the petrels. For about ten days hundreds of birds have remained near us. They are mostly white petrels, but there are also giant and brown petrels and a few brown sea-gulls.

At noon there was just a slight suggestion of a sunburst, but it is growing feebler and feebler. The

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beams of light come to us at such an ineffective angle that our noonday is not now brighter than our twilight of a month ago. The sun is constantly veiled by a bank of frozen mist which prevents our seeing its departing splendour, but there is an occasional break which offers us for a few seconds a view of his fading face. It is sad, cold, and expressionless. The accustomed heat is absent, and the light is a despairing gray glow which, on the surface ice, makes long blue shadows. Still, despondent as this seems in comparison to brighter days, it is the only source of direct light and heat which we now have. It is the only show of seeming cheerfulness in this gloomy world of blackness into which we are fast drifting. This feeble burst of lost noonday splendour is the last draft of life which now fans the fading cinders of the soul, while the death-dealing darkness is doing its devilish work of extinguishment.

May 15.—Unless we get a clear sky sometime during the night, we shall not be able to determine the exact commencement of the long night. If our position is approximately where our dead reckoning places us, we should have seen the sun for a few minutes at noon to-day for the last time; but the sky was too hazy to give us this last peep. In the south-east there is a dull, creamy light on the clouds, which suggests the presence of a high country, reflecting an ice-blink. The west and north, in the morning and afternoon, were marked by a dark, purple-blue zone. At noon the light was so feeble that we could not see the outline of the hummock on the pack.

Our floe, the sheet of ice into which the *Belgica*

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is frozen, now offers a sad appearance. It is cracked, torn, rasped, ground, and so swept by thawing storms that the picturesque glory of its glowing days has gone. And what is still more disheartening is that, torn and fractured as the field is now, it no longer affords us a safe harbour, free of crushing influences, as it did when all about was one solid mass. The thick bed of soft spotless snow, which softened the sharp edges and cushioned the rough irregularities, has been reduced to a mere film through which the hard blue ice, with its savage roughness and its gloomy skeleton-like projections, is clearly seen. The unique velvety and wavy surface has given way to an ugly water-soaked plane of hard ice. We have watched the field grow by the addition of one floe after another, and we have steadily increased our comfort upon its bosom. Our sense of safety has grown with the augmented breadth and thickness. We have, to some extent, helped to harbour the *Belgica* by walls of snow; but Nature here has curious moods. With one hand she protects, with the other she destroys, — she aided us by drifting around the ship an enormous amount of snow, but she has injured us by breaking that which sheltered us.

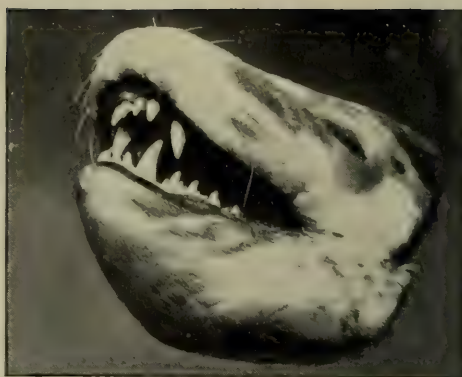
We have learned to regard this *Belgica* field as a little polar farm preserved for our special benefit, to harbour us safely through the long night which is before us. It is a substitute for land, though it drifts about with the wind, and on its edges we find products in the form of seals and penguins. But this faith in security and prospective rest in a solid unbroken crust has now vanished and at a time when we most need it.

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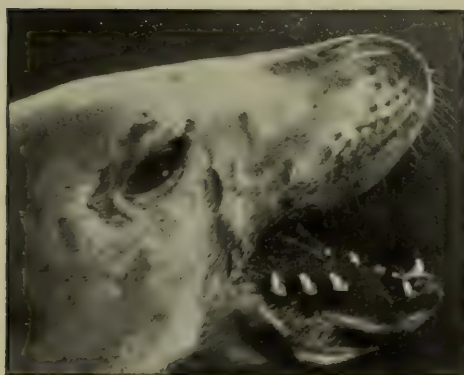
Only a month ago the broadest diameter of the field was four miles. About two weeks ago an assault began along the outer edge of the north and south. Huge fragments were torn off, bits of other fields were pushed on by neighbouring sheets. Little by little our field has been reduced to less than half its former size; but the *Belgica* always escaped this battle of Nature until this morning. Now the field is completely destroyed and the bark is again among the pieces in the sea, taking hard thumps from the restless ice. We are somewhat anxious about the safety of our outhouses. There are several crevasses near Danco's observatory. The captain's "hotel," from which he sights the stars, is threatened by a crevasse under it, and Arctowski has gathered up all his instruments and placed them aboard for safe keeping. It is just these little black spots about the vessel which add the suggestion of a village and a home to our otherwise dull surroundings. (However, the threatened destruction did not proceed beyond a lively scare. On the day following the ice came together, the temperature fell, the fissures closed, and a heavy fall of snow gave the *Belgica* a soft feathery bed in which she rested until relieved by our own hands.)



True Sea-Leopard.
(*Ogmorhynchus Leptonyx.*)



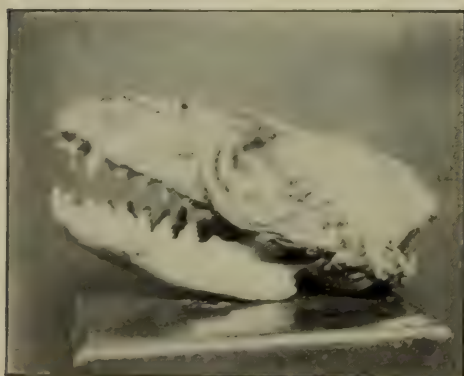
True Sea-Leopard.
(*Ogmorhynchus Leptonyx.*)



Crab-eater.
(*Lobodon Carcinophaga.*)



True Sea-Leopard.
(*Ogmorhynchus Leptonyx.*)



Crab-eater.
(*Lobodon Carcinophaga.*)



False, or Weddell Sea-Leopard.
(*Leptonychotes Weddelli.*)

CHAPTER XXI

THE SOUTH POLAR NIGHT—DEPARTURE OF THE SUN.

MAY 16.—The long night began at 12 o'clock last night. We did not know this until this afternoon. At 4 o'clock Lecointe got an observation by two stars which placed us in latitude $71^{\circ} 34' 30''$, longitude $89^{\circ} 10'$. According to a careful calculation from these figures the captain announces the melancholy news that there will be no more day—no more sun for seventy days, if our position remains about the same. If we drift north the night will be shorter, if south it will be longer. Shortly before noon the long prayed-for southerly wind came, sweeping from the pack the warm, black atmosphere, and replacing it with a sharp air and a clearing sky. Exactly at noon we saw a brightening in the north. We expected to see the sun by refraction, though we knew it was actually below the horizon, but we were disappointed. The cold whiteness of our earlier surroundings has now been succeeded by a colder blackness. Even the long, bright twilight, which gladdened our hearts on first entering the pack, has been reduced

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to but a fraction of its earlier glory ; this now takes the place of our departed day.

The winter and the darkness have slowly but steadily settled over us. By such easy stages has the light departed that we have not, until now, appreciated the awful effect. The circumstance has furnished a subject for our conversation for most of the time which we now mis-name day, and a large part of the sleeping hours of the night. It is not difficult to read on the faces of my companions their thoughts and their moody dispositions. We are all wandering northward — homeward, with the fugitive sun. The curtain of blackness which has fallen over the outer world of icy desolation has also descended upon the inner world of our souls. Around the tables, in the laboratory, and in the fore-castle, men are sitting about sad and dejected, lost in dreams of melancholy from which, now and then, one arouses with an empty attempt at enthusiasm. For brief moments some try to break the spell by jokes, told perhaps for the fiftieth time. Others grind out a cheerful philosophy ; but all efforts to infuse bright hopes fail.

Each man is intent on being left alone to take what comfort he can from memories of happier days, though such effort usually leaves him more hopelessly oppressed by the sense of utter desertion and loneliness. For six weeks we have been so intent in prosecuting the various lines of research and in preparing the bark, as well as our clothing and equipment for the winter, that we have not with sufficient interest, noticed the melancholy decline of the day. It has gone slowly, and the persistent storms have

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so screened the heavens that it has vanished as if by stealth. Now, however, the gloom of night which has so rapidly followed its lengthening shadow, has suddenly impressed upon our passive minds the awful individual loneliness, and the unfathomable solitude of this impenetrable antarctic wilderness.

Henceforth, for a period which is a blank in human history, the fair-haired goddess of light will repose beneath the polar star over the more hopeful arctic lands. Her pathway is no longer over the familiar hummocks and icebergs and the even spreads of this icy desert under the Southern Cross. Her silvery tresses have swept for the last time this sea of frozen wave; her departing breath has stilled, as by the hand of death, the bosom of this great body of water upon which we have cast our fortunes.

May 17.—At ten o'clock this morning the purple twilight curve settled over the south-west, edged with an indescribable blending of orange, red, and gold, and at eleven o'clock this curve was met by a zone of rose which gradually ascended over the north-east, above the sun. The ice, which had been gray, was lighted up by a lively flash of pink, which was relieved by long river-like leads of open water having a glowing surface of dark violet. These, however, were the surface colours towards the sun. In the opposite direction there was an entirely different effect. The snow had spread evenly over it a delicate shade of green, while the waters were a very dark purple-blue. A few minutes before twelve a great, distorted, ill-defined semi-globular mass of fire rose over the north, edged along the line of sharp hummocks, and

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then sank beneath the ice. It was an image of the sun, lifted above its actual position by the refractive character of the air, through which its light passed to our eyes. It was in reality an optical illusion, based upon the principle that if a beam of light is compelled to pass through a medium of various densities, as the air here is sure to be, its course is deflected. The sun, then, though actually below the horizon to-day, was raised by this apparent uplift and we were able to see one-half of his face.

We have been fishing through the sounding hole to-day with hooks, but our efforts proved disappointing. The hooks, when we raised the complicated deep-sea apparatus, were missing. Either some submarine monsters have taken the hooks or they have dragged on a rocky bottom. The temperature at 9 A. M. was -12° C., and the weather shows signs of clearing, though the wind is veering northerly.

It is remarkable how a little incident, especially one surrounded by some mystery when brought suddenly into our horizon, will arouse great excitement. This does not often happen, which accounts for the air of lethargy and disinterestedness which is coming over us with the increase of darkness. The weird outline of the dying face of the setting sun a few days ago, and the premonitions of the seventy sunless days through which we are now to pass, aroused a new sensation. The extraordinary effects of the moon, vague lights and shadows on the horizon, indicating the possible outline of a new land; an occasional peak of a new iceberg coming into our plane of vision; the uncommon changes of the

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auroras, of the weather, and the visit of a penguin or a seal, all incite new life, but the inspiration is of short duration. In a few hours the soul sinks again into its sleep which is induced by the long night of months. This morning, however, there was an incident which startled everybody in a manner quite unusual.

At about seven o'clock the captain went out to find two stars from which to obtain an observation for position. The sky was too hazy to give him an observation, but his eye rested upon an inexplicable speck of light in the west. He stood and looked at it for some moments. It did not change in position, but sparkled now and then like a star. The thing came suddenly, disappeared and again reappeared in exactly the same spot. It was so curious and assumed so much the nature of a surprise, that Lecointe came into the cabin and announced the news. We accused him of having had too early an eye-opener, but we went out quickly to see the mystery. It was about eight o'clock; the sky was a streaky mouse colour. The ice was gray, with a slight suggestion of lilac in the high lights, but the entire outline of the pack was vague under a very dark twilight. We looked for some time in the direction in which Lecointe pointed, but we saw only a gloomy waste of ice, lined in places by breaks in the pack from which oozed a black cloud of vapour. We were not sure that the captain's eyesight was not defective, and began to blackguard him afresh.

After we had stood on the snow-decked bridge for ten minutes, shivering and kicking about to

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keep our blood from freezing, we saw on a floe some distance westward a light like that of a torch. It flickered, rose and fell, as if carried by some moving object. We went forward to find if anybody was missing—for we could only explain the thing by imagining a man carrying a lantern. Everybody was found to be on board, and then the excitement ran high. Soon all hands were on deck and all seemed to think that the light was being moved towards us. Is it a human being? Is it perhaps some one from an unknown south polar race of people? For some minutes no one ventured out on the pack to meet the strange messenger. We were, indeed, not sufficiently dressed for this mission. Few had had breakfast; all were without mittens and hats, some without coats, and others without trousers. If it were a diplomatic visitor we were certainly in an uncomfortable and undignified uniform with which to receive him. Amundsen, who was the biggest, the strongest, the bravest, and generally the best dressed man for sudden emergencies, slipped into his *annorak*, jumped on his *ski* and skated rapidly over the gloomy blackness of the pack to the light. He lingered about the spot a bit, and then returned without company and without the light, looking somewhat sheepish. It proved to be a mass of phosphorescent snow which had been newly charged by sea algæ, and was occasionally raised and brushed by the pressure of the ice.

May 18.—During the few hours of midday dawn we made an excursion to a favourite iceberg to view the last signs of the departing day. It was a weird

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jaunt. I shall always remember the peculiar impression it produced upon me. When we started almost all the party were outside, standing about in groups of three or four, discussing the prospects of the long winter night and the short glory of the scene about. A thing sadder by far than the fleeing sun was the illness of our companion, Lieutenant Danco, which was emphasised to us now by his absence from all the groups, his malady confining him to the ship. We knew at this time that he would never again see a sunrise, and we felt that perhaps others might follow him. "Who will be here to greet the returning sun?" was often asked.

My companions on the excursion were Gerlache and Amundsen. Slowly and lazily we skated over the rough surface of the snow to the northward. We had not gone far before we discovered that the ice was cracking and large leads were cutting off our retreat. We mounted hummocks of unusual height, and there awaited the imitation of the rising of the sun. Where the ice broke it separated, leaving a lane of black sea, from which oozed a peculiar vapour—in reality a cloud of small icy crystals which fell on the neighbouring ice-fields. The countless miniature mountains, or hummocks, which covered the white fields, had their northern faces brightened by a pale yellow light and their southern shadowed by a dull blue. This gave a little light to the usual lifeless gray of the ice-fields. Along the fresh leads there were a few penguins and an occasional seal, and in the water, whales were spouting jets of breath.

The pack, with the strange play of deflected light

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upon it, the subdued high lights, the softened shadows, the little speck of human and wild life, and our good ship buried under its snows, should have been interesting to us ; but we were interested only in the sky and in the northern portion of it. A few moments before twelve the cream-coloured zone in the north brightened to an orange hue, and precisely at noon half of the form of the sun ascended above the ice. It was a misshapen, dull semicircle of gold, heatless, rayless, and sad. It sank again in a few moments, leaving almost no colour and nothing cheerful to remember through the seventy long days of darkness which followed. We returned to the ship, and during the afternoon laid out the plans for our midwinter occupation.

May 20. — It is the fifth day of the long night and it certainly seems long, very long, since we have felt the heat of the sun. During the parting days of light the weather was exceedingly unsteady, and the sky was then constantly veiled by a frozen smoky vapour, but now a disturbing element seems to have been withdrawn. The horizon is not yet clear, but the zenith is almost always high and blue, with the Southern Cross generally visible until nine o'clock in the morning and after three o'clock in the afternoon. From eleven to one o'clock at noon to-day there was light enough thrown over the northern ice to read ordinary print outside, but in our rooms it is necessary to burn lights continually. The little midday twilight is used to make soundings and to secure the fauna and flora of the shallow sea under us. Those not engaged in this work are busied in still more



An Old Lead.



A New Crevasse.

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snugly housing the *Belgica* and in shoveling pathways around the ship. I have selected this part of the day to take a daily walk over the pack to neighbouring floes, and to distant icebergs, to study the ice and the life, and to obtain sufficient physical exercise, as well as mental recreation, to retard the spell of indifference which is falling over me.

For fifteen minutes before and after twelve o'clock the sky and the ice are flooded by a wealth of fascinating colours. The northern sky is such that one momentarily expects the sun to rise. Here are the warm shades of red and yellow and on the snow, looking in this direction, there is a noticeable flesh colour in which one sees fetching lines of lilac. In the opposite direction there are some weird shades of blue-black and a few dead sheets of gray-blue in shadowed surfaces, in the caverns of bergs, and in the fissures, but the mixed shades of green and purple and violet are also displayed with crystal purity. I cannot describe this short spell of mid-day glory as it impresses me. If I could wield a brush, and lay these colours on canvas I feel that one of the ambitions of my life would be accomplished. But I cannot—and what am I to do in black, with an overworked pen, frosty ink, and a mind which is wearied as soon as the cheer of noon-day passes?

To the first of May our health had been fairly good. We have had little complaints and some insignificant injuries, bruises, cuts, strains, and frost bites, but there has been little of which to make a medical note. Since entering the pack our spirits have not improved. The quantity of food which we

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have consumed, individually and collectively, has steadily decreased and our relish for food has also slowly but steadily failed. There was a time when each man enjoyed some special dish and by distributing these favoured dishes at different times it was possible to have some one gastronomically happy every day. But now we are tired of everything. We despise all articles which come out of tin, and a general dislike is the normal air of the *Belgica*. The cook is entitled, through his efforts to please us, to kind consideration, but the arrangement of the menu is condemned, and the entire food store is used as a subject for bitter sarcasm. Everybody having any connection with the selection or preparation of the food, past or present, is heaped with some criticism. Some of this is merited, but most of it is the natural outcome of our despairing isolation from accustomed comforts.

I do not mean to say that we are more discontented than other men in similar conditions. This part of the life of polar explorers is usually suppressed in the narratives. An almost monotonous discontent occurs in every expedition through the polar night. It is natural that this should be so, for when men are compelled to see one another's faces, encounter the few good and the many bad traits of character for weeks, months, and years, without any outer influence to direct the mind, they are apt to remember only the rough edges which rub up against their own bumps of misconduct. If we could only get away from each other for a few hours at a time, we might learn to see a new side and take

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a fresh interest in our comrades; but this is not possible. The truth is, that we are at this moment as tired of each other's company as we are of the cold monotony of the black night and of the unpalatable sameness of our food. Now and then we experience affectionate moody spells and then we try to inspire each other with a sort of superficial effervescence of good cheer, but such moods are short-lived. Physically, mentally, and perhaps morally, then, we are depressed, and from my past experience in the arctic I know that this depression will increase with the advance of the night, and far into the increasing dawn of next summer.

The mental conditions have been indicated above. Physically we are steadily losing strength, though our weight remains nearly the same, with a slight increase in some. All seem puffy about the eyes and ankles, and the muscles, which were hard earlier, are now soft, though not reduced in size. We are pale, and the skin is unusually oily. The hair grows rapidly, and the skin about the nails has a tendency to creep over them, seemingly to protect them from the cold. The heart action is failing in force and is decidedly irregular. Indeed, this organ responds to the slightest stimulation in an alarming manner. If we walk hurriedly around the ship the pulse rises to 110 beats, and if we continue for fifteen minutes it intermits, and there is also some difficulty of respiration. The observers, going only one hundred yards to the observatories, come in almost breathless after their short run. The usual pulse, too, is extremely changeable from day

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to day. Now it is full, regular, and vigorous; again it is soft, intermittent and feeble. In one case it was, yesterday, 43, to-day it is 98, but the man complains of nothing and does his regular work. The sun seems to supply an indescribable something which controls and steadies the heart. In its absence it goes like an engine without a governor.

There is at present no one disabled, but there are many little complaints. About half of the men complain of headaches and insomnia; many are dizzy and uncomfortable about the head, and others are sleepy at all times, though they sleep nine hours. All of the secretions are reduced, from which it follows that digestion is difficult. Acid dyspepsia and frequent gastric discomforts are often mentioned. There are also rheumatic and neuralgic pains, muscular twitchings, and an indefinite number of small complaints, but there is but one serious case on hand. This is Danco. He has an old heart lesion, a leak of one of the valves, which has been followed by an enlargement of the heart and a thickening of its walls. In ordinary conditions, when there was no need for an unusual physical or mental strain, and when liberal fresh food and bright sunshine were at hand, he felt no defect. But these conditions are now changed. The hypertrophied muscular tissue is beginning to weaken, and atrophy of the heart is the result, dilating and weakening with a sort of measured step, which, if it continues at the present rate, will prove fatal within a month.

May 22.—It is clear and still. The temperature has fallen to -19° C., and altogether, though sunless,

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this sharp, cold weather at present is more agreeable to us than the dull, stormy days with warmth and light a month ago. It is Sunday, and we have nearly all been out for a jaunt on *skis*. We took some photographs, but they are ugly, because there is nothing distinct in the pictures. It is not possible to make good, clear pictures except on bright moonlight nights or on sharp, sunny days. It is the custom aft to go into the masthead and scan the horizon for signs of life, before starting on our tours of recreation. In this way we are reasonably sure to return with a penguin, a seal, or the story of an adventure. To-day we saw a seal about a mile from the ship, but when we got to it the animal started towards the *Belgica*. We urged it on and drove it easily to our home. The creature looked about with much curiosity when it came to the rough, dirty snow about the bark, and searched diligently for a hole through which it might plunge to the sea below. But no such hole or crevasse was within a mile of us, for the calm cold of the past week has reunited all the broken fragments into large fields. We threw a rope around the seal, which was a crab-eater, intending to take its temperature and make other physiological experiments, but the thing was too slippery and too lively for us. Several instruments were broken, and some very strong ropes were snapped like ordinary twine. Finally the seal was shot, and its skeleton was prepared to enrich a Belgian museum of natural history. There was to-night a bright aurora. It began as a straight horizontal zone low on the southern sky. Later it changed

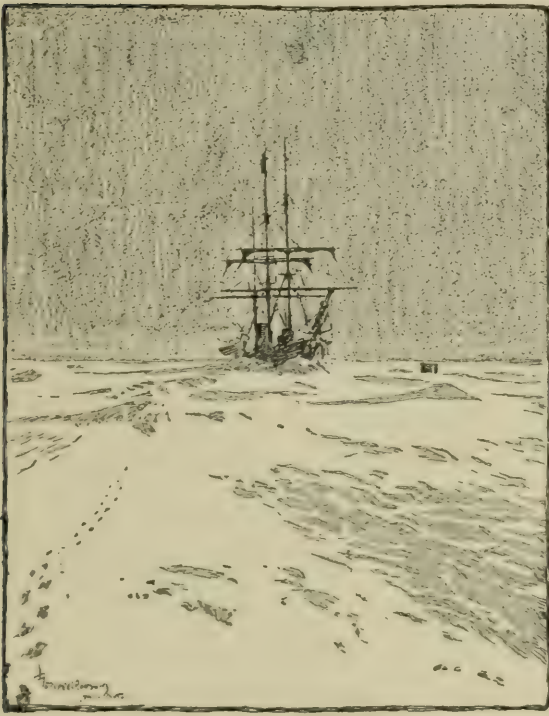
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to an arc with the parts of two other arcs below it. A similar phenomenon appeared last night.

May 27.—The little dusk at midday is fading more and more. A feeble deflected light falls upon the elevations, the icebergs, and the hummocks, offering a faint cheerfulness, but this soon withdraws and leaves a film of blackness. The pack presents daily the same despondent surface of gray which, by contrast to the white sparkle of some time ago, makes our outlook even more melancholy. The weather is now quite clear and in general more settled. The temperature ranges from 5° to 10° C. below zero. We have frequent falls of snow, but the quantity is small and the period is short. Generally we are able to see the stars from two in the afternoon until ten in the morning. During the four hours of midday the sky is generally screened by a thick icy vapour. There are a few white petrels about daily, and in the sounding hole we have noticed a seal occasionally, but there is now no other life. All have an abundance of work, but our ambition for regular occupation, particularly anything which requires prolonged mental concentration, is wanting; even the task of keeping up the log is too much. There is nothing new to write about, nothing to excite fresh interest. There are now no auroras, and no halos; everything on the frozen sea and over it is sleeping the long sleep of the frigid night.

CHAPTER XXII

THE SOUTH POLAR NIGHT (CONTINUED)— DAYS OF DISCONTENTMENT.



A Helpless Ship in a Hopeless
Sea of Ice.

THE grayness of the first days of the night has given way to a soul-despairing darkness, broken only at noon by a feeble yellow haze on the northern sky. I can think of nothing more disheartening, more destructive to human energy, than this dense, unbroken blackness of the long polar night. In the arctic it has

some redeeming features. There the white invader has the Eskimo to assist, teach, and amuse him. The weather there is clear and cold; and in the regions about Greenland, where I have been engaged, there

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is land—real solid land, not the mere mockery of it, like the shifting pack that is about us here. With land at hand, prolonged journeys are always possible, but what are we to do on a moving sea of ice?

May 29. — Yesterday we had a warm northerly gale with much snow and a thick fog. The ice is again in rapid motion. There are many new leads, numerous pressure angles, and fresh fissures in the ice. Danco is steadily failing. To day is Sunday; the men look forward with some anticipation to this day because Sunday is set aside, not as a day of worship, for I have never seen a man on the *Belgica* with a Bible or prayer-book in his hands, but as a time of freedom from usual duties. It is the weekly period of recreation and special feeding. The few eatables which are still relished are placed on the menu for Sunday. This serves to mark time and to divide, somewhat, the almost unceasing sameness of our life.

This morning had in it no element of promise or cheer. Even at noon it was dark and gloomy. But the wet, warm, northerly wind of yesterday is blowing its last breath. The cold air of the upper atmospheric stratus is settling down over us again, as it always does in an approaching calm. In this region nothing is more conducive to comfort than a sharp atmosphere with a low temperature. Warm weather is nice enough in summer or in more temperate latitudes; but in this sea of ice and in midwinter, it is far from desirable. Aside from the personal discomforts, high temperature in our position adds enormous dangers to our safety. The ice, now being firmly congealed, is crushed and thrown from one part of



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the ever restless sea to another. It is broken, crushed, and ground into a snowy powder, which only too well indicates to us what would become of our vessel if it were torn from its present bed.

Last night a tremendous force was expended against the end of our floe, which made the sleeping *Belgica* quiver from stem to stern; but, fortunately, the good old iceblock held together, while the smaller ice pans around her were pushed on the surface with a groan like that of a man in dire pain. To-day all is quiet, no pressure groans, no noise of animals, no wind, even the usual noise on board has ceased. Since three o'clock the temperature has fallen three degrees every hour. Now, at eight o'clock, it is -25.2° ; this is our favourite temperature and what a joy it brings. The day is, perhaps, as a Sunday ought to be, cold, solemn, and silent. A feeble arc aurora appeared at about nine o'clock to-night. It was in the usual position, but the exhibit was so faint that had we not been trained by our previous observations, the phenomenon would have passed unrecognised.

May 31.—By a careful observation Captain Leconte deduces our latitude to $71^{\circ} 36'$, longitude $87^{\circ} 33' 30''$. For about a week we have drifted very little. The longitude has changed slightly, but since the 18th we have gone southward about nineteen miles. To the present this is our farthest point southward. On the 20th of March we were at $71^{\circ} 35'$, longitude $88^{\circ} 02'$, a position very near that at present. (The latitude of this day, $71^{\circ} 36'$, proved to be our farthest south during the entire drift with the pack.)

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The morning is perfect, as we regard weather. The thermometer is at -23° C. There is almost no wind, and every break in the pack is covered by a thick sheet of new ice. We expected cold, clear weather, but it was otherwise yesterday and last night. The wind howled, the ice was again torn into small pieces, and there was a great amount of pressure evident in the lines of hummocks running easterly and westerly. Either we have come against some obstruction southward, or the northerly pressure is extraordinary. During the night we were anxious about the safety of the *Belgica*; for, as the fury of the wind rushed over us, the ice was broken and the vessel was subjected to a great amount of pressure. The ice is heaped up around the *Belgica* in huge walls from five to twenty feet in height. The floes are turning, giving the good old ship hard jabs in her ribs. She takes the savage blows with an agonizing moan. Although the pressure has been such that we packed our kits and were prepared to try the hospitality of the pack, there has been no real injury which we can discover. We were extremely glad, this morning, to find that the broken ice had been reunited, and we soon learned that the raised walls about would prove an effective embankment in future battles with the storms.

At noon there was a faint show of a dawn. The sky in the north was touched with light fiery clouds. The snow had upon it not the slightest suggestion of this red, but remained a dull gray, while the sky above was a smoky blue. One not familiar with the freaks of polar day would have thought the sun

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would surely rise, or that it had just sunk under the snow, but we know only too well that we are doomed to see it make a fainter and fainter display at noon for three more weeks.

Precisely at twelve o'clock a strange rectangular block of fire appeared in the east-south-east. Its size was that of a small tabular iceberg, but it had a dull crimson glow which made the scene at once weird and fascinating. Its base rested on the horizon and it seemed to rise, brighten, and move northerly. The sky here was a purple, thinly veiled by a light smoky haze, caused by icy crystals in the lower stratus of atmosphere, but there was not another speck of redness on this side of the heavens except the orange bow usually seen over the twilight zone. We watched this with considerable awe and amazement for ten minutes before we could determine its meaning. It passed through several stages of forms, finally it separated, and we discovered that it was the moon. It was in fact a sort of mirage of the moon, but the strange rectangular distortion, the fiery aspect, and its huge size, made a sight long to be remembered.

During the past days of the night we have made soundings of the sea, and have taken samples of submarine and surface life. This has given Arctowski and Racovitza an abundance of work. It is interesting to see them plod along, working steadily and faithfully in the dark laboratory, packing away specimens, jotting down notes, stooping over the microscopes and other instruments, always with a pencil in one hand, and a stick in the other to greet

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the first man who dares to interrupt them in their den. Poor fellows! — their faces are tired and drawn, as if some great calamity had come upon them. Danco is keeping up with doggish persistency his magnetic observations, the details of which are such that he is almost constantly occupied during working hours. He is steadily failing, but he complains little and keeps up a kind of abnormal cheerfulness.

The meteorological work is now the most troublesome task, for it requires some one to make the observations every hour, and sometimes oftener. Each of us had planned a work of some magnitude to be completed before sunrise. Commandant de Gerlache started to rewrite the ship's log. Lecointe began to complete the details of the summer's hydrographic work. Racovitza, in addition to regular laboratory work, was to plan the outlines of a new book on the geographical distribution of life. Arcowski had in mind a dozen scientific problems to elucidate. Amundsen entered into a co-partnership with me to make new and more perfect travelling equipment; and in addition to this, I had the anthropological work of the past summer to place into workable order, and a book on antarctic exploration. Thus we had placed before us the outline for industrious occupation; but we did little of it. As the darkness increased our energy waned. We became indifferent, and found it difficult to concentrate our minds or fix our efforts to any one plan of action. (The work mapped out was partly accomplished, but it was done after the return of the sun.)

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The regular routine of our work is tiresome in the extreme, not because it is difficult of execution or requires great physical exertion, but because of its monotony. Day after day, week after week, and month after month we rise at the same hour, eat the same things, talk on the same subjects, make a pretense of doing the same work, and look out upon the same icy wilderness. We try hard to introduce new topics for thought and new concoctions for the weary stomach. We strain the truth to introduce stories of home and of flowery future prospects, hoping to infuse a new cheer; but it all fails miserably. We are under the spell of the black antarctic night, and, like the world which it darkens, we are cold, cheerless, and inactive. We have aged ten years in thirty days.

Here is an outline of a day's life on the *Belgica*. Rise at 7.30 A.M.; coffee at 8; 9 to 10, open air exercise; 10 to 12, scientific work, such as the regular meteorologic, magnetic, or laboratory tasks, for the officers; and for the marines, bringing in snow, melting snow for water, replenishing the ship's stores, repairing the ship, building new quarters, making new instruments, and doing anything which pertains to the regular work of the expedition; 12 to 2 P.M., dinner and rest or recreation; 2 to 4, official work (regular work during this period was suspended for the greater part of the night); 6 to 7, supper; 7 to 10, card-playing, music, mending, and, on moonlight nights, excursions. At ten o'clock we went to sleep.

Up to this time our health had been fairly good.

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Excepting a few light attacks of rheumatism, neuralgia, and some unimportant traumatic injuries, there had been no complaint. We ate little, however, and were thoroughly disgusted with canned foods. We had tried the meat of the penguins, but to the majority its flavour was still too "fishy." We entered the long night somewhat underfed, not because there was a scarcity of food, but because of our unconquerable dislike for such as we had. It is possible to support life for seven or eight months upon a diet of canned food; but after this period there is something in the human system which makes it refuse to utilise the elements of nutrition contained in tins. Against such food, even for a short period, the stomach protests; confined to it for a long period, it simply refuses to exercise its functions. Articles which in the canning retain a natural appearance usually remain, especially if cooked a little, friendly to the palate. This is particularly true of meat retaining hard fibers, such as ham, bacon, dried meats, and corned beef. It is also true of fruits preserved in juices; and vegetables, such as peas, corn, tomatoes; and of dried things. Unfortunately this class of food formed a small part of our store. We were weighed down with the supposed finer delicacies of the Belgian, French, and Norwegian markets. We had laboratory mixtures in neat cans, combined in such a manner as to make them look tempting — hashes under various catchy names; sausage stuffs in deceptive forms, meat and fishballs said to contain cream, mysterious soups, and all the latest inventions in condensed foods. But they one and all proved failures, as a steady diet. The stomach

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demands things with a natural fiber, or some tough, gritty substance. At this time, as a relief, we would have taken kindly to something containing pebbles or sand. How we longed to use our teeth !

The long darkness, the isolation, the tinned foods, the continued low temperature, with increasing storms and a high humidity, finally reduced our systems to what we call polar anaemia. We became pale, with a kind of greenish hue ; our secretions were more or less suppressed. The stomach and all the organs were sluggish, and refused to work. Most dangerous of all were the cardiac and cerebral symptoms. The heart acted as if it had lost its regulating influence. Its action was feeble, but its beats were not increased until other dangerous symptoms appeared. Its action was weak, irregular, and entirely unreliable throughout the night. The mental symptoms were not so noticeable. The men were incapable of concentration, and unable to continue prolonged thought. One sailor was forced to the verge of insanity, but he recovered with the returning sun. The first to feel the effects of polar anaemia seriously was our lamented friend and companion, Lieutenant Danco. With the descent of the sun began the beginning of his end. On the short journeys which we took during the few moments of noonday twilight Danco complained of shortness of breath. Indeed, we all had some difficulty of respiration upon the slightest exercise, but Danco would frequently stand still and gasp. For this he came under medical care early in May, but in spite of every effort he rapidly sank.

June 1.—It is now difficult to get out of our warm

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beds in the morning. There is no dawn,—nothing to mark the usual division of night and morning until nearly noon. During the early part of the night it is next to impossible to go to sleep, and if we drink coffee we do not sleep at all. When we do sink into a slumber, it is so deep that we are not easily awakened. Our appetites are growing smaller and smaller, and the little food which is consumed gives much trouble. Oh, for that heavenly ball of fire! Not for the heat—the human economy can regulate that—but for the light—the hope of life.

June 2.—The night was very cold with a wind veering from south-west to west, coming in puffs with a coldness that made the ice and the rigging of the *Belgica* groan. At about six o'clock last night, while a stiff wind was blowing, the ice fractured around the *Belgica* and allowed her to sink gradually into the water out of which she had been raised. The squeaking of the ship, the groaning of the ice, and the howling of the wind, were for a short time maddening. After a time we became accustomed to this and sank our anxiety and some fear (though we hesitated to own it) in a lively game of whist. This proved to be the coldest night thus far— 29° C. (-20.2° F.).

I had resolved to rise at seven o'clock, but owing to the lethargy due to the long darkness and the profound sleep, I did not find myself out of my berth until eleven. When I arise at this time I omit the formality of a breakfast, and of this my stomach does not complain. Four months ago, during the antarctic summer, to omit breakfast would have been to reject one of the delights of polar life, but now in this



The Small Pack Penguin (*Pygosulis Adeliae*).



The Royal Penguin (*Aptenodytes Forsteri*).

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melancholy darkness it is like being relieved of a weighty duty.

June 3.—The men forward are kept busy with the usual work of the ship, cleaning, restowing, repairing sails, ropes, and woodwork, etc. One man is constantly occupied in keeping the fires going. Another man keeps up the supply of snow, which is melted for water. The work of sounding, taking deep sea temperatures, and fishing, keeps many busy. For much of the time it is also necessary to employ several men to keep the vessel well banked with snow, and the observatories need a similar attention. Thus the sailors are evenly occupied in easy work which keeps them from feeling the melancholy of our isolation from the world, and also helps them to forget the prolonged darkness of this dayless night.

Our floe has again grown to encouraging dimensions. From the mere fragment, which remained after the last severe disturbance, it has gradually taken unto itself pan after pan, until now we can no longer see its end. On the sky we observe mouse-coloured bands at noon, which tell us that there are a few fissures where a heavy mist rises from the open water. This is the usual water-sky in miniature. From the shape of these dark streaks we know the size and outline of the open water under it. The bergs change position a little, new ones occasionally crowd over our horizon and remain visible a short time, then return to their old positions; old ones turn about somewhat, thus presenting a new face to us. Some are raised by a mirage, and all are buried under the gloomy veil of blackness

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which is so rapidly spreading over the once white splendour.

We have had much snow within a fortnight, which by the aid of the varying winds has drifted over the icy hummocks and ridges, raised by pressure, and made for us a substitute for Mother Earth once more. On *ski* and snowshoes we can again travel about for miles on the newly-assembled old floe. But the position marking the old leads and lakes is still difficult for pleasurable journeys. These places resemble in their contour a bird's-eye view of a large city. To cross them is as if we tried to cross a city over the roofs of the houses. Still, it is possible to travel in this wilderness of ice if one is fortunate enough to have polar patience, and a body which can be tossed about like a football. Our floe, with all its roughness, with all its faults, is nevertheless a providential protection to the good little *Belgica* and a godsend to its occupants.

We are all eating appreciably less now than during the bright season—and either there is a constant inclination to sleep or persistent insomnia. We eat an amount of fat, however, that would surprise most people; fat pork, fatty meats, the pure oil of bacon, and tremendous quantities of oleomargarine, are consumed with apparent relish. This is to me particularly surprising because during three arctic voyages I never noticed any particular craving for fat; but this I ascribe to the fact that we always ate liberally of fresh meats north, and these we have not here. We eat a little penguin with a show of pleasure, but most of us are quite tired of its marine

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flavour and fish-oil smoothness. If we had sufficient ham it would afford immense gastric delight. There is much indigestion now — fermentation, gastric inertia, intestinal and gastric pain, imperfect hepatic action, and a general suppression of all the digestive secretions. The heart is unsteady, easily disturbed, and mitral murmurs, which I have not heard before, are audible. Temperatures, almost without exception, are subnormal. The breathing is often difficult, the blood retreats from the skin, but the larger veins are abnormally full. Piles, hemorrhoids, headache, neuralgia, rheumatism, are the systemic complaints ; but while we all have our little disorders, no one is really disabled.



Saennagras

A Swedish grass which was used in the boots to protect the feet.

CHAPTER XXIII

THE SOUTH POLAR NIGHT (CONTINUED)— THE DEATH OF DANCO

THE weather is unendurable, the temperature is -30° C. and an easterly gale is burying us in a huge drift of snow. With a high wind, an air thick with flying snow, and a temperature such as we have had for the past three days, ranging from -28° to -30° , it is utterly impossible to exist outside in the open blast. In calm weather such a temperature causes delight, but in a storm it gives rise to despair. I think it is Conan Doyle who says, "What companion is there like the great restless, throbbing polar sea? What human mood is there which it does not match and sympathise with?" I should like Mr. Doyle to spend one month with us on this great, restless, throbbing sea, under this dense, restless, throbbing blackness of the antarctic night. I am sure he would find conditions to drive his pen, but where is the companionship of a sea which with every heave brings a block of ice against your berth making your only hope of life, the bark, tremble from end to end. Where is the human being who

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will find sympathy in the howling winds under the polar night?

For several days our beloved companion Danco has been failing. From nearly the very first day of his sickness I saw that, coming upon him as it had done in the dusk, it must prove fatal during the long antarctic night. To pass through a polar night, with its prolonged and awful cold, and remain well is a very difficult matter even for a man with sound organs. One who has not these, and perfect health, always fares badly in these sunless and lifeless polar days. Danco has had, unconsciously, for years a serious heart defect. For a time the heart walls increased in strength and thus a safe equilibrium was established; but to keep an even or compensatory balance, mild exercise was necessary in the open air with an abundance of sunlight. The sun has now been entirely absent for more than a fortnight, and for forty days its light has been of no physiological service. The atmosphere has been so constantly filled with snow and ice-crystals that, at best, the sun shone with less brilliancy than the moon, and that only for a few moments at midday. During all of this time Danco has not felt well; his manly courage, however, is such that he will not complain. But as the darkness becomes blacker, and the frigid night advances he has been compelled to surrender himself a candidate to the sick list.

June 4.—The ice is again breaking and the pressure of the floes, as they ride over each other, makes a noise converting the otherwise dark quietude into a howling scene of groans. It is again snowing and

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the wind keeps veering from the north-west to north-east.

Whenever we have advanced on our mysterious drift with the restless pack, either far east or far south, or both, we are arrested in our progress and the temperature falls. In the east there is also great pressure, and it is only in the far east or south that we get easterly or southerly winds. These winds have the character of land breezes—extremely dry, with a low temperature—followed by delightful, clear weather. From these facts we must conclude that the east and south are lined with land of large proportions or islands united by ice. An easy wind south or west drives us quickly; indeed, at times we drift northward without wind. The bergs now seem to press north and east.

June 5.—To-day we have to record the darkest page in our log—the death of our beloved comrade, Danco. It has not been unexpected, for we have known that he could not recover, but the awful blank left by his demise is keenly felt, and the sudden gloom of despair, thus thrown over the entire party, is impossible of description. Poor fellow! in the past forty-eight hours he had been steadily improving, and, although we were not encouraged by this, he felt so much better that he was cheerful and altogether more like his former self, but it was the calm before the storm. Without any premonition of his coming death Danco passed away easily to-night; his last words to me were, “I can breathe lighter and will soon get strength.” A companion with noble traits has left us. The event is too sad

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to note in detail. His life has steadily and persistently sunk with the northerly setting of the sun. In ordinary health, his circulation was so nicely balanced that it needed but the unbalancing element of the prolonged darkness to disturb the equilibrium, and send him to a premature grave.

June 7.—We have made a bag of sail-cloth, and into it the remains of Danco have been sewn. This morning we searched the crevasses for an opening which might serve as a grave. We found no place sufficiently open, but with axes and chisels we cut an aperture through the young ice in a recent lead, about one hundred yards from the bark. Owing to the depressing effect upon the party, we found it necessary to place the body outside on the ice upon a sledge the day after the death. At a few minutes before noon to-day the commandant, followed by the officers and scientific staff, came to this sledge. The crew, dressed in an outer suit of duck, then marched out and, taking the drag rope, they proceeded over the rough drifts southerly to the lead. The day was bitterly cold, with a wind coming out of the south-west. Much snow in fine crystals was driven through the air, and it pierced the skin like needles. The surface of the ice was gray, but the sky had here and there a touch of brightness. In the north there was a feeble metallic glow, and directly overhead there were a few stratus of rose-coloured clouds. The moon, fiery, with a ragged edge, hung low on the southern sky. There was light enough to read ordinary print, but it was a weird light. Danco was a favourite among the sailors, and his departure

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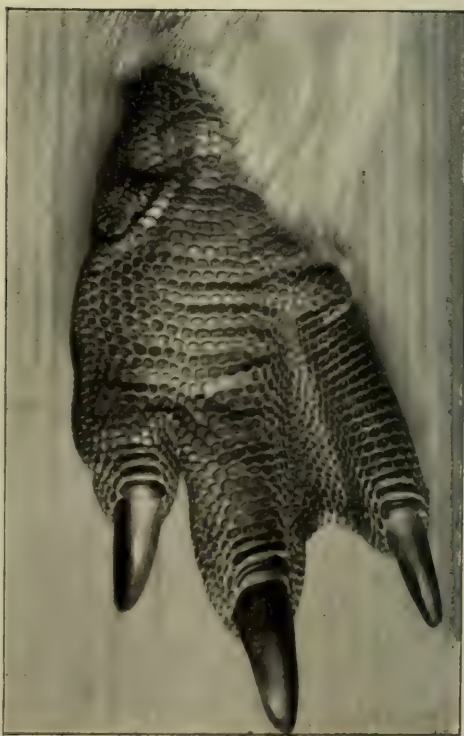
was as keenly felt in the forecastle as among us. The men expressed this in the funeral procession. Slowly but steadily they marched over the rough surface of the ice with an air of inexpressible sadness. The sledge was brought to the freezing water. Here the commandant made a few fitting remarks, and then two heavy weights were attached to the feet, and the body was entrusted to the frosted bosom of the antarctic ocean.

June 8.—The melancholy death, and the incidents of the melancholy burial of Danco, have brought over us a spell of despondency which we seem unable to conquer. I fear that this feeling will remain with us for some time, and we can ill afford it. Though there are none among us sick at this time, we may at any moment have small complaints which will become serious under this death-dealing spell of despair. We are constantly picturing to ourselves the form of our late companion floating about in a standing position, with the weights to his feet, under the frozen surface and perhaps under the *Belgica*.

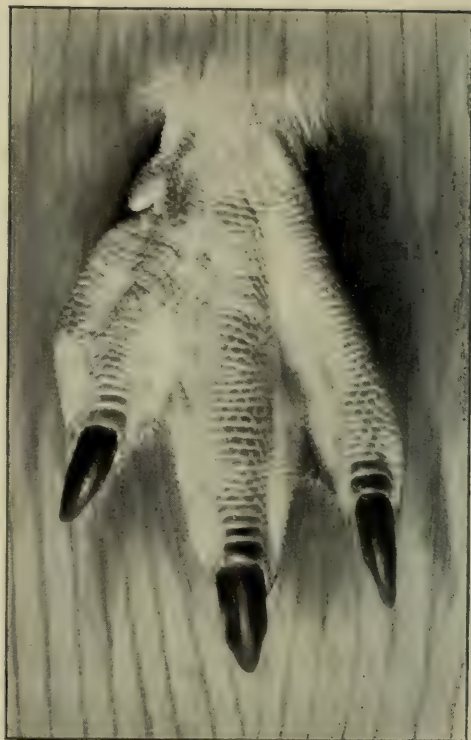
June 10.—The temperature remains low. Yesterday it fell to -32° C. (-25.6° F.), and it seems to linger about the twenties. The weather is more and more settled and steady, as the night advances and the cold increases. The wind is moderate, and it intermits with calm periods, but the barometer is very high. There is little movement in the ice; all the crevasses and leads are closed by new ice, and the *Belgica's* berth is now positively secure for a long time to come. The small floes, into



Head and Foot of the Royal Penguin.
(*Aptenodytes Forsteri*.)



Head and Foot of the Small Pack Penguin. Showing
the Changed Summer Plumage under the Bill.
(*Pygoscelis Adeline*.)



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which the ice was broken ten days ago, have been pushed over and under each other in such a manner, that the bark has been raised out of the water with an uncomfortable list. We have seen no life for a long time, but there is no open water near. We are inclined to believe that when there is a space of open sea there will be found some life, even at this time.

It is the doctor's birthday. We have had a special feast with champagne. Many efforts were made to lighten the spirits of the men, but our efforts were only of temporary duration. The captain has made the greatest endeavour to break the spell of "shivers" which hung over us. He fixed up in his full-dress suit, and induced the doctor to do the same. In this costume we came to the dining table, and took the cabin by surprise. After a half-hearted meal, a full-hearted exchange of greetings followed a certificate of honour, presented by Captain Lecointe.

DOCTOR COOK:

I make fast the occasion of your anniversary in order to exprime all the sympathy you suggest to me.

In proof of that friendship, and because of that great day, I take the engagement to repair one pair of your knit stockings.

Dixi,

G. LECOINTE.

Antarctic Ocean, S. Y. *Belgica*, June 10, 1898.

The amusement, however, was expensive to us, for we shivered and felt most uncomfortable. We

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had not worn stiff collars nor boiled shirts in seven months; nor had we the custom of arranging neckties and holding our heads and bodies steady enough for the tight fit of our suits. Lecointe made a nautical observation in the suit with an ordinary winter overcoat. The temperature was about -20° C. The stars used for the observation were Jupiter and Canis Majoris, and the position as fixed was latitude $71^{\circ} 20' 7''$, longitude $87^{\circ} 17' 50''$. Lecointe declared that he would never try the experiment again. He came to the cabin shivering with a chill, which did not entirely pass off for some minutes.

June 12.—The barometer still continues very high, but we are momentarily expecting a reaction. Already the temperature has fallen from -25° to -2° C., and it promises to fall still more. The west is black, and out of its gloom comes a half-gale with wet snow. The *Belgica*, feeling the effect of the sudden change in the temperature, is alive with weird noises. The masts, the spars, the ropes, and every projecting object have long been covered by a thick encasement of accumulating hoar-frost. Heavy pieces of this ice-plating are loosened by the warm draught of the winds and they fall to the decks below with thunderous bolts. The bark changes its position in its bed of ice somewhat like its occupants in their bunks, and this is followed by a long series of jars and groans. Altogether, the noise outside and in is maddening. We hope for a speedy return of cold weather to our favourite temperature somewhat below -20° C.

June 16.—No wind; a few cirrus and stratus

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clouds; the stars at zenith are visible at noon. The Southern Cross over the mizzenmast is arrayed in all its glory. The sun has only five minutes more to recede before it reaches the equinox, and then it will come back slowly and perceptibly, with its life-giving rays. We are drifting eastward, but there is no sign of movement in the ice,—no cracks, no leads, no lakes.

June 17.—We are still drifting eastward, slowly but steadily, which fact suggests several questions: Is there land to the eastward or southward? If so, what is its character? If not, why are the easterly and southerly winds cold and dry, and why are we checked in our drift, after passing far eastward or southward? There are but two explanations. First: It is possible that we are far off a continuous coast line, or nearly so, in which case the ice near the land, with a westerly wind, would be forced toward the point of least resistance, which would generally be north. This would explain what we have often noticed, a northerly drift with a westerly wind. But even with our checked progress we seem to move eastward too quickly for such a condition of things. The next probability seems to explain better our actual experience. The second explanation is, that the easterly drift of the ice is only checked by a few widely separated islands through which the pack is forced into the Weddell sea by the prevailing wind. When the sun returns, and the ice loosens its grasp on our bark, we hope to clear up this mystery.

We are having considerable trouble in keeping

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our stoves burning. With the use of soft coal it is necessary to disturb the fire often, which makes the air unendurable because of the escape of poisonous gases, while it also fills the room with smoke and soot and ashes. The moisture which leaves the room through the stove draughts is condensed in the pipes and mixed with soot; the whole mass freezes, which occludes the opening of the pipe. To remove this obstruction it is necessary to take out the pipes once weekly and clean them, an operation of no little consequence in polar regions. This is the second expedition with which I have been connected where we have had the same trouble. It would be entirely overcome by the use of anthracite coal for the winter fires, instead of the bituminous, with its unnecessary filth.

Mr. Peary has tried to overcome this by a substitution of oil stoves, but such a procedure, in my judgment, is not only accompanied by a polluted atmosphere causing headaches, insomnia, and difficulty of respiration, but it is quite dangerous to life. A coal fire removes from a room most of its poisonous gases and keeps up a free circulation of air, but an oil stove does just the reverse. An oil or a gas stove consumes air in a somewhat similar manner to man. It burns oxygen and gives off carbon dioxide and other gases. An ordinary oil stove will consume as much oxygen as fifteen men, and it does not replace the polluted air, as does a coal or wood fire. There is another point, which has been too little regarded in polar ventures. During the long months of winter darkness the life-giving rays of the sun are with-

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drawn, leaving the summer whiteness of the earth in cold and despondent blackness. Bright artificial lights relieve this to some extent, but all the animal organism is in a condition similar to that of a planet deprived of the direct sunlight. The skin is pale, the muscles are weak, and the organs refuse to perform their functions with usual vigour. This effect is most noticeable in the action of the heart which, during the long night, is deprived of its regulating force; now quick, now slow; then strong, again feeble, but never normal. The best substitute for this absence of the sun is the direct rays of heat from an open fire. From an ordinary coal or wood fire the effect is wonderful. I have stripped and placed men, before the direct rays of heat, whose pulse was almost imperceptible, and in the course of less than an hour had a heart action nearly normal. From an oil stove it is quite impossible to get this effect, hence its use in polar regions should be confined to camp life.

The selection of proper means for obtaining artificial light is quite as important as that of heat. Electric light is ideal, but the means for obtaining electricity are not easily transported. Candles are said to be the safest and best for general use; but the illumination of a single candle is so feeble that each man must have one or more in general use. From this it results that candles are posted in all parts of the rooms,—in the bunks and other nooks where a conflagration might easily originate. Hence the danger of a fire by candles is quite as great as that of petroleum lamps, while the light is far inferior to

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it. A good petroleum lamp is undoubtedly the most practical. But even a petroleum lamp has its drawbacks in polar regions. On the *Belgica* we had several, and about fifty glass chimneys, all of which were broken during the past few weeks of the antarctic night. We were then bound to utilise the ingenuity of the mechanics on board to make substitutes. The geologist, who is a chemist by profession, made the first trial with glass tubes; this was better than nothing, but the assistant engineer next took the matter in hand, and after a time became quite a lamp specialist. He altered the construction of the lamp and of the burner; made chimneys of glass jelly jars, removing the bottom and placing over all a zinc funnel. On the whole it was a very happy contrivance, and while it was not quite perfect it served the purpose for which it was intended, during the balance of the black night.

June 19.—A midwinter and a midnight thaw, with the ice breaking and pressing upon the vessel, is the most dreadful thing which could happen to us now. But it is just this most despairing condition of ice and weather which is threatening us in these darkest days of the midnight. The temperature and the wind for three days have suddenly risen. It is now blowing a gale from the west. The temperature is -2° ; the ice is breaking and separating, leaving wide endless leads running northward and southward. Between the gloomy clouds northward there is a faint suggestion of brightness, but this only seems to increase our longing for light. It is dark! dark! Dark at noon, dark at midnight, dark every hour of

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the day. And thus we jog along day after day, through the unbroken sameness. There is plenty of work close at hand. The weather should be carefully studied; the sky and the frozen sea contain problems for solution. We are in a world unknown, but just at present we care little about our novel position or our future rewards.

The darkness grows daily a little deeper, and the night soaks hourly a little more colour from our blood. Our gait is now careless, the step non-elastic, the foothold uncertain. The hair grows quickly, like plants in a hot-house, but there is a great change in the colour. Most of us in the cabin have grown decidedly gray within two months, though few are over thirty. Our faces are drawn, and there is an absence of jest and cheer and hope in our make-up which, in itself, is one of the saddest incidents in our existence. There is no one willing to openly confess the force of the night upon himself, but the novelty of life has been worn out and the cold, dark outside world is incapable of introducing anything new. The moonlight comes and goes alike, during the hours of midday as at midnight. The stars glisten over the gloomy snows. We miss the usual poetry and adventure of home winter nights. We miss the flushed maidens, the jingling bells, the spirited horses, the inns, the crackling blaze of the country fire. We miss much of life which makes it worth the trouble of existence.

At noon some of us went on a *ski* journey, and about a mile south-east of the ship we were stopped by a wide lead of inky water, extending north and

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south as far as the sight could reach. The darkness was such that we dared not approach closely to the open sea. We were anxious to search the fringe of ice bordering on the gloomy water for animal life, and discussed the possibilities for some time, but the thickening veil of darkness drew over us tighter and tighter as we waited. Looking toward the *Belgica* we saw that she was already nearly obscured by the sooty blackness, which was falling from the noon-day heavens. Looking over the silent and endless sea of ice, however, the aspect was not one of night. A subdued glow seemed to rise from the white snows and illuminate the lower stratas of air; but this was only apparent. Nearly all irregularities were obscured or distorted. Huge hummocks, ten to twenty feet high, were not observed until we stumbled against them. Small elevations, with sharp angles, sometimes produced a mirage like that of an iceberg at a great distance. We would glide along leisurely on *ski* and suddenly find that we had crossed this huge obstacle,—in reality only a few inches in height.

For the past month we have not felt like writing. Our humour and our ambition are not such as to make us transfer ideas to paper easily. If I could write poetry I should like to select the topics of conversation as subjects for gloomy moods,—for we certainly painted the skies darker, and made the snow blacker, than they ever appeared in reality. We made a feeble attempt to lift the gloomy seal, now and then, by a superficial humour,—a sort of frothy effervescence of

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the soul, but the efforts were as feeble as our anaemic muscular fibres. The long polar night lies heavily upon us. Our health has suffered considerably. We have not been so fortunate as Nansen's party, if we may accept Nansen's account of the health of his crew at the dawn of the arctic day. With a few boastful remarks he passes over the physical effects of the arctic night, and concludes to his own elation that they felt none of the usual complaints; but since it is reported that one of the best men has returned mentally deranged, of which Nansen leaves us in ignorance, we may infer that other matters have also slipped his memory. It is not possible for an expedition, with twelve men, to live three years in the arctic or any other region without some bodily ailments. These are as certain as human sins, and quite as interesting, but we look for them in vain in Nansen's narrative. Perhaps Dr. Blessing or some other member of the expedition will give us a more serious account.

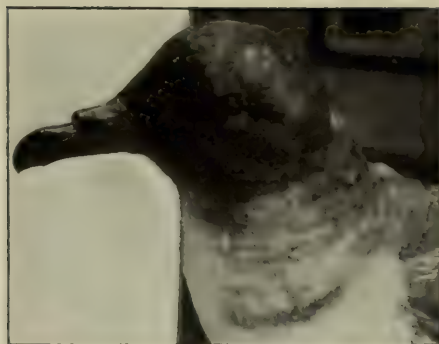
In my experience with polar expeditions, and from every reliable record which I have been able to find where the observations have been given by honest and competent observers, there is a general agreement in the description of the physical effects of the polar night. Anaemia, or a condition allied to it, in one form or another and under various descriptions is always found if sought by an experienced eye. This malady we have had in by far the severest form which I have noticed in any arctic experiences, and more severe than is recorded in the literature of polar

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exploration. We have lost one officer, and a second barely escaped death. The marines are all afflicted; the condition is truly alarming. At present I have the captain in the "baking treatment." He is pale and yellowish, with a feeble, almost imperceptible, pulse of from 100 to 140,—his recovery, while hopeful, is uncertain.



Giant Petrel.
(*Ossifraga gigantea*.)



Megalestris.
(*Megalestris antarctica*.)



Giant Petrel.
(*Ossifraga gigantea*.)



Giant Petrel.
(*Ossifraga gigantea*.)



Megalestris.
(*Megalestris antarctica*.)



Antarctic Petrel.
(*Thalasseoca antarctica*.)



Giant Petrel.
(*Ossifraga gigantea*.)

CHAPTER XXIV

THE SOUTH POLAR NIGHT (CONTINUED). MIDNIGHT TO DAWN

June 22.—It is midnight and midwinter. Thirty-five long, dayless nights have passed. An equal number of dreary, cheerless days must elapse before we again see the glowing orb, the star of day. The sun has reached its greatest northern declination. We have thus passed the antarctic midnight. The winter solstice is to us the meridian day, the zenith of the night as much so as twelve o'clock is the meridian hour to those who dwell in the more favoured lands, in the temperate and tropical zones, where there is a regular day and night three hundred and sixty-five times in the yearly cycle. Yesterday was the darkest day of the night; a more dismal sky and a more depressing scene could not be imagined, but to-day the outlook is a little brighter. The sky is lined with a few touches of orange, the frozen sea of black snow is made more cheerful by the high lights, with a sort of dull phosphorescent glimmer of the projecting peaks of ice. The temperature has suddenly fallen to— 27.5° C. at noon, and the wind is coming out of the south with an easy force which

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has sent all the floating humidity of the past few days down, leaving an air clear and sharp. There will be an eclipse of one of the satellites of Jupiter this afternoon, and from an observation of this phenomenon the industrious captain expects to regulate our chronometers. He hopes also to get a good observation to fix our position, for we are somewhat anxious to know just where we are in this unknown world during the important days of the midnight.

June 24.—For the past three days we have had steady cold weather with a temperature from -15° to -28° C. (-18.4° F.), and every night we have also had a brilliant aurora in the usual position, at about the usual hour. Auroras have been conspicuously absent from our skies for nearly two months. There was a feeble display on May twenty-ninth, and possibly a few faint exhibits have evaded our notice, but since the end of April there has been no auroral phenomenon which has attracted general interest. With this clear weather there is a noticeable brightness at noon. To-day the northern sky has a tinge of orange-red, limited by a band of green with a bit of the moon over it. Overhead we can see the Cross and other stars of the same magnitude. Our position, as calculated yesterday, is now far east, latitude $70^{\circ} 47' 45''$, longitude $83^{\circ} 43' 45''$. A sounding at this point would be interesting. For this purpose we have tried to cut a new hole through the ice. The old opening was closed by the disturbance and pressure of a fortnight ago, and since we have not been able to make another, but to-day we are desperately at work, chopping and cutting ice

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for a fishing and sounding hole. Having found that the canvas suits are entirely inadequate to retain the bodily heat, we are also trying to devise some more effective clothing.

June 26.— It is Sunday ; the weather is warm, wet, and too stormy to permit our usual Sabbath excursions. We are playing cards and grinding the music-boxes, and trying in various ways to throw off the increasing gloom of the night ; but something has happened which has added another cloud to the hell of blackness which enshrouds us. One of the sailors brought with him from Europe a beautiful young kitten. This kitten has been named “Nansen,” and it has steadily grown into our affections. “Nansen” was at home alike in the forecastle and in the cabin, but with characteristic good sense he did not venture out on exploring trips. A temperature thirty degrees below zero was not to his liking ; the quarters about the stove and the bed of a favourite sailor were his choice. Since the commencement of the long darkness he has been ill at ease, but previously he was happy and contented, and glad to be petted and loved by everybody. The long night, however, brought out all the bad qualities of his ancestors. For nearly a month he has been in a kind of stupour, eating very little and sleeping much. If we tried to



Nansen, the Mascot.

Drawn by Koren, the Cabin Boy.

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arouse him he displayed considerable anger. We have brought in a penguin occasionally to try to infuse new ambitions and a new friendship in the cat, but both the penguin and the cat were contented to take to opposite corners of the room. Altogether "Nansen" seemed thoroughly disgusted with his surroundings and his associates, and lately he has sought exclusion in unfrequented corners. His temperament has changed from the good and lively creature to one of growling discontent. His mind has wandered and from his changed spiritual attitude we believe that his soul has wandered too. A day or two ago his life departed, we presume for more congenial regions. We are glad that his torture is ended, but we miss "Nansen" very much. He has been the attribute to our good fortune to the present, the only speck of sentimental life within reach. We have showered upon him our affections, but the long darkness has made him turn against us. In the future we shall be without a mascot and what will be our fate?

June 29. — Since my last writing there has been nothing to mark time or disturb the gloom of the long black monotony. The temperature has been high with its usual accompaniment of stormy discomfort. Yesterday and the day before the thermometer rose to zero and everybody accordingly rose to a spirit of discontent. Such disaffections are always heaped upon the meteorologist who is blamed for all the freaks of the weather, but he receives no credit for the blessings of the steady cold weather which we like.



Amundsen After a *Ski* Run.

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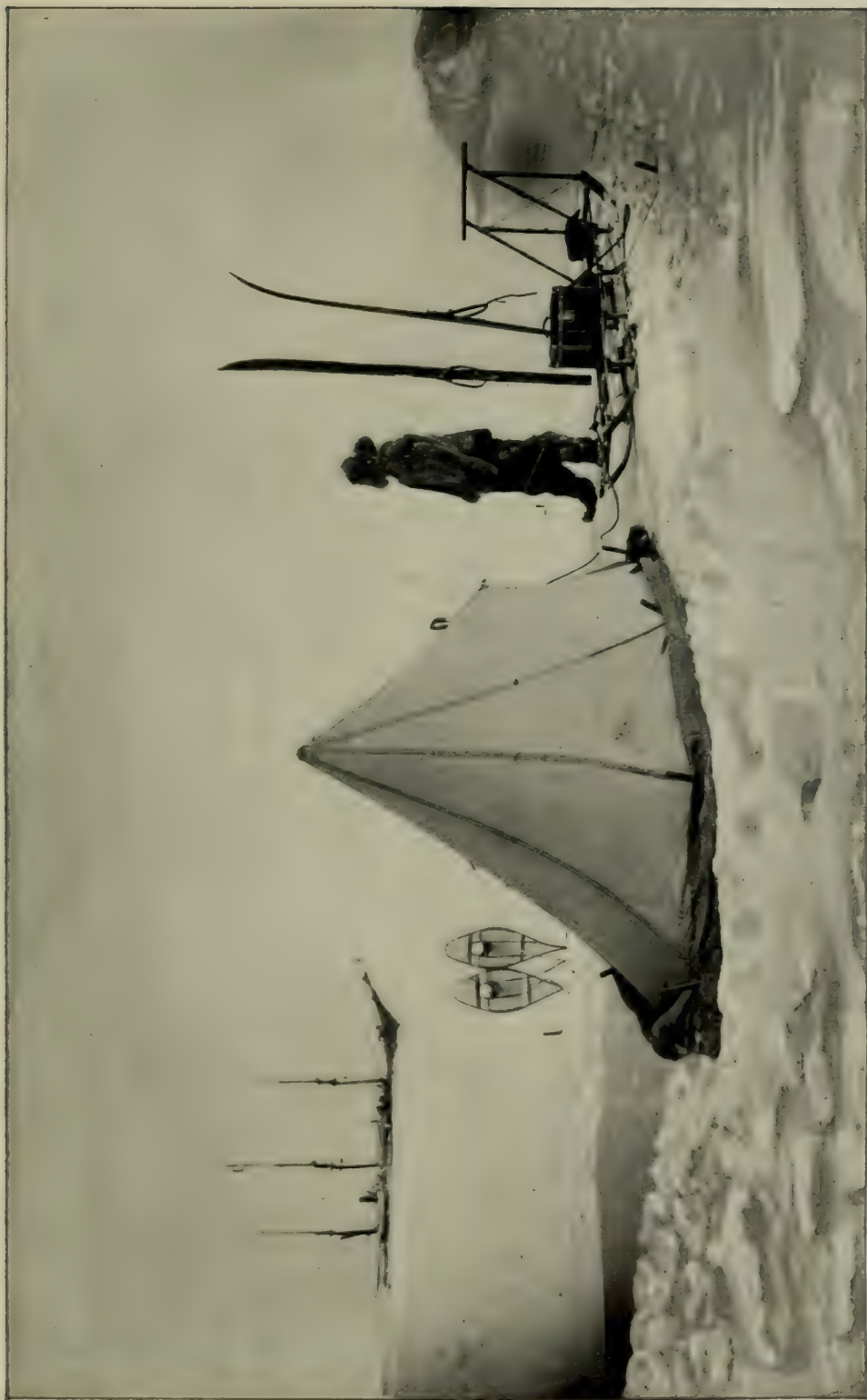
July 4.—It is the day of the Declaration of Independence of the United States. With characteristic Belgian thoughtfulness the Commandant has ordered a special feast and has sent up the Stars and Stripes to float over the *Belgica* to be waved by the virgin antarctic breezes. America and American affairs are the topics around which our ideas revolve to-day. It is curious to watch our thoughts wheel around the incidents of current events. The beauty contest in April was succeeded by heated discussions and sentimental philosophy for several weeks. This was followed by the serious sentiments caused by the last sight of the sun and the death of Danco. Then followed a lot of light talk about "Nansen," the cat, and his future. Has he a soul and is there a Heaven for him? To-day we are building up a United States of Europe, and are dreaming of annexing Canada and all of South America into one grand Union of States.

There is a strong, steady, westerly wind charged with great quantities of drift snow. The ice is separating, leaving wide, endless, ice-free leads running north and south. In these we have seen a few finback whales, spouting, and sporting, and courting, in the midday twilight. The increasing light at noon is now very evident. From 10 A. M. to 2 P. M. on bright days it is clear enough to make *ski* runs over the pack, without tumbling over the many hummocks which a week ago were invisible. Though the curtain of night is lifting, the men, when carefully examined, show an alarming physical condition. Almost everybody when questioned vows that

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he feels well, complaining only of a lack of ambition, but the actual condition is otherwise. We are pale and green about the facial folds. A slight exercise makes us gasp for breath, and the heart runs at an alarming speed. We now make it a rule to take an hour's walk outside in a path about the bark, and during these walks the men easily freeze parts of the face, the fingers and toes, without knowing it. The reason for this is the blunted condition of our senses and the enfeebled circulation, with imperfect blood.

July 8.—The temperature is again falling; to-day it is -30° C. (-22° F.) All of the leads and open spaces of water of a few days ago are covered with ice thick enough to travel over without fear of breaking through. In this new ice there are small holes about two inches in diameter. Along the edge of these holes is a ring of silvery hoar-frost, and out of it there comes a jet of vapour every few minutes. These are the blow-holes of seals, and the puff of vapour is the expired air of the animals as they breathe. We have been anxious to see these seals, for we have seen none since sunset, more than fifty days ago. They must have come southward from the outer edges of the pack, through the open leads a few days ago. In travelling over the new ice we found a place to-night where the new ice had been broken, and out of it came one seal after another, until about twenty had mounted to the surface of the old ice. They all marched towards us, and when within fifteen feet they stopped, sniffed the air, grunted, showed their teeth,



The *Belgica* in September. The New Tent and the Pack Travelling Outfit.

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and then sought for a comfortable place to sleep. Evidently our odour was not to their liking, for they ignored our presence until we attacked them a half hour later. We killed three, and surrounded two with the intention of driving them to the *Belgica*. After a long chase over a tortuous path we brought the animals to the side of the bark, and there examined them scientifically and gastronomically at our leisure.

June 10.—It is a bright, calm day, with a gentle air from the south and a temperature of -30° C. The men are scattered over the pack in little clicks. The Norwegians are quite separated from the Belgians, and all are on *ski*. Some are aiming for a favourite nook where there is a prospect of finding seals or penguins; others are striking out for a hummock eastward, which offers a splendid slope for *ski* exercises. We of the cabin have formed a small party to make the first long journey. There is an iceberg about two miles westward which had been the favourite spot for *ski* sport in the early winter, and we are anxious to see what effect the winter has wrought upon this berg.

We had no serious difficulty in reaching the berg; the ice was much crevassed, and about the leads were great lines of hummocks which made *ski* travelling a task; but we were unencumbered and had become somewhat accustomed to rough roads. We started shortly after one o'clock. It took us an hour to reach our destination, and we spent about forty minutes on the berg and about it, but then, noticing that the light was quickly departing, we

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hurried home. The winter effect upon the berg had been considerable. The pack-ice about it had been much broken and raised in numerous hummocks by pressure. To the westward side a great quantity of ice had been forced upon the berg to a height of twenty feet, indicating what we had expected, that the prevailing pressure during the night had been from the west. The old crevasses were mostly closed, and the sharp, projecting spires were coated with great quantities of coarse hoar-frost. There was no evidence about the berg to warrant a belief in an upbuilding of bergs during the winter. On the contrary the signs were indicative of their having been considerably reduced in bulk. On our way back we secured one king penguin, the first during the night, and it will be a pleasant addition to our larder.

July 12.—The light is daily increasing at midday, which should be a potent encouragement, but we are failing in fortitude and in physical force. From day to day we all complain of a general enfeeblement of strength, of insufficient heart action, of a mental lethargy, and of a universal feeling of discomfort. There has, however, been one exception; one among us who has not fallen into the habit of being a chronic complainer. This is Captain Lecointe. The captain has had to do the most trying work, that of making the nautical observations, which often keeps him handling delicate instruments outside, and in trying positions in the open blast for an hour at a time. He has come in with frosted fingers, frozen ears, and stiffened feet, but with char-

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acteristic good humour he has passed these discomforts off. His heart action has steadily remained full and regular. The only other man in the party of equal strength is the cook, Michotte. But to-day I have to record the saddening news that Lecointe is suddenly failing. Not that he has complained of any ill-feeling, for he still maintains that he feels well; but in the usual daily examination, I notice that his pulse is intermitting, the first sign of coming debility. He is assuming a deathly pallor, does not eat, and finds it difficult to either sleep or breathe. There is a puffiness under the eyes, his ankles are swollen, and the entire skin has a dry, glossy appearance. The symptoms are all similar to those of Danco in his last stages; but Lecointe has a steady heart and sound organs, which augur in his favour.

July 14.—Lecointe has given up all hope of ever recovering, and has made out his last instructions. His case seems almost hopeless to me. The unfavourable prognosis has sent another wave of despair over the entire party. Almost everybody is alarmed and coming to me for medical treatment, for real or imaginary troubles. The complaints differ considerably, but the underlying cause is the same in all. We are developing a form of anæmia peculiar to the polar regions. An anæmia which I had noticed before among the members of the first Peary Arctic Expedition, but our conditions are much more serious. To overcome this trouble I have devised a plan of action, which the sailors call the “baking treatment.”

Medicament, I find, is of little service. A tempo-

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rary relief is sometimes effected by well-directed drugs, but the lasting effects are disappointing. Iron and arsenic, and many of the ordinary tonics effective in home anæmias, are entirely inert. After considerable experiment, I have abandoned drugs as an important aid. Fresh food, artificial heat, a buoyant humour, judicious clothing, and the least possible humidity are the conditions which suggest a rational treatment. I should like to take up this subject in detail and give my reasons for this plan of treatment, but the discussions would take us into a long and technical consideration, which I fear would be of interest only to medical men. The plan of treatment in brief is as follows: As soon as the pulse becomes irregular and rises to one hundred beats per minute, with a puffiness of the eyes and swollen ankles, the man is stripped and placed close to a fire for one hour each day. I prohibit all food except milk, cranberry sauce, and fresh meat, either penguin or seal steaks fried in oleomargarine. The patient is not allowed to do anything which will seriously tax the heart. His bedding is dried daily, and his clothing is carefully adjusted to the needs of his occupation. Laxatives are generally necessary, and vegetable bitters, with mineral acids, are a decided help. Strychnine is the only remedy which has given me any service in regulating the heart, and this I have used as a routine. But surely one of the most important things was to raise the patient's hopes and instil a spirit of good humour. When at all seriously afflicted, the men felt that they would surely die, and to combat this spirit of abject hopelessness was my



THE GARDNER & GREENHILL COLLECTION

Twilight Amid The Antarctic Ice

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most difficult task. My comrades, however, were excellent aids, for as soon as one of our number was down, everybody made it his business to create an air of good cheer about him.

The first upon whom I tried this system of treatment systematically was Lecointe. I had urged part of it upon Danco, but he could not eat the penguin, and when I told him he must, he said he would rather die. When Lecointe came under treatment I told him that if he would follow the treatment carefully I thought he would be out of bed in a week. I did not have this faith in the treatment at that time, but I had confidence in the soundness of Lecointe's organs and I wished to boom up the man. Lecointe replied by saying, "I will sit on the stove for a month and eat penguins for the rest of my polar life if that will do me good." (He did sit beside the stove two hours daily for a month, and he ate, by his own choosing, penguin steaks for the balance of his stay in the polar circle. In a week he was about, and in a fortnight he again made his observations, and for the rest of his polar existence he was again one of the strongest men on the *Belgica*).

For a number of days the temperature has remained below -30° C. Yesterday and to-day it has ranged from -34° to -37° C, with a strong southerly and westerly wind. With such temperatures and a strong wind it is impossible to exist outside. One freezes the extremities so quickly that it is positively dangerous to be out; but in still weather there is no temperature too low to prevent outdoor work.

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To-day the ice is separating, leaving leads running eastward and westward, but for a week past the entire horizon has been one solid, unbroken mass. There is no life visible, but we have seen tracks of both the royal and the small penguins.

July 15.—The weather continues cold, but clear and calm, the only three qualities which make the antarctic climate endurable during the night. There is now much light. One can read ordinary print at 9 A.M., and at noon the north is flushed with a glory of green and orange and yellow. We are still very feeble. An exercise of one hour sends the pulse up to 130, but we have all learned to like and crave penguin meat. To sleep is our most difficult task, and to avoid work is the mission of everybody. Arc-towski says, "We are in a mad-house," and our humour points that way.

July 17.—If we had not fresh meat to eat and an abundance of fuel to give heat, I am sure we would have an alarming mortality in less than a month. Several lives have certainly been saved by eating penguins, and we shall always owe them a debt of gratitude. And now the sun though invisible is rising higher and higher under the horizon, giving us a long dawn from nine until three o'clock. Everybody is advancing in cheerfulness with the rising sun, but physically we are in a deplorable condition. Alcohol, even in small quantities, has now a deleterious effect upon us. We have been accustomed to take light wines at meals, but the wine has a bad effect upon the heart and kidney functions, so much so that we have stopped its use altogether.

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July 19.—The health of the sailors is at its minimum. All are anæmic, but their general appearance is as good as at any previous time. They look strong and rugged, and have not lost weight; but their complexion is somewhat pale and yellowish. When they work outside for an hour the pulse runs up to from 120 to 150. In the cabin we are improving, but the Commandant, Arctowski, and Amundsen are making a slow recovery. On our excursions we now see many seal and penguin tracks, and the northern sky gives every promise of soon sending forth the sun. The shades of dawn are first green, then orange-red, followed by a bright yellow, so bright that one almost imagines a sight of the upper rim of the sun. The ice for days has been intensely purple. We have had a few feeble auroras during the past two nights, beginning at about three o'clock and lasting for only a short time. The sky is losing its bright, cheerful and restful blueness, which it has exhibited during the past fortnight of cold and comparative calm. A thin veil of gray is gathering over us, which presages another spell of warm, stormy, and dirty weather. The barometer is very high, the temperature is falling, and to-night there is a wind from the north. All of this, as usual, is an introduction to a wind from a warmer and more humid region,—the north and west.

July 21.—Yesterday the temperature was but one degree below zero, and for two days the weather has been warm and stormy. To-day it is again -24° C. A beautiful, clear and cloudless day—

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with a cheerful glow of reflected splendour radiating over the northern horizon. At eight o'clock the sky above the sun was a joyous golden; at noon it was crimson. We have not had an observation in twelve days, and are thus unable to determine our exact position; hence it will be impossible to calculate with precision the day of the rising of the sun, after its long and wandering debauch. We saw two white petrels, the first except one which we saw two weeks ago, since the first days of the night. There are no open leads or bands of water-sky.

Three days have been declared as official holidays. It is the time for the Belgian national feasts, and we are making, during this period, hard efforts to boom up the failing spirits of the men. Special foods have been prepared to please the palates; wines are sparingly served to infuse an air of good cheer, and we try to steer the topics of conversation in such a manner that a new interest may be created, but it seems to me that all of our good intentions in this direction are wasted. Arctowski and Dobrowolski are in a bad way. Knudsen, Johansen and Melaerts are in the baking treatment, and altogether we are in a deplorable condition. If it now became necessary to throw suddenly a difficult physical task upon the men there would be few able to endure it. If we were compelled to make a prolonged march over the cheerless pack we should fail miserably. In the cabin we know this helpless condition perfectly well, but we try to push it to the background and talk of the usual home sentiments of the feast, the coming sun, and the brighter prospects of a coming sum-



A Hunter Taking a Sun Bath.



The Last to Enter the Three-Man Sleeping Bag.

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mer campaign of exploration. The sailors, always anxious for a holiday, though their work is never severe, are assembled in groups, some in the fore-castle playing cards, others scattered over the pack on snowshoes drinking in the glory of the coming day.

The night is clear and sharp, with a brightness in the sky and a blueness on the ice which we have not seen since the first few days after sunset. An aurora of unusual brightness is arched across the southern sky. The transformation in its figure is rapid, and the wavy movement is strikingly noticeable. We are all out looking at the aurora, some by way of curiosity, but others are seriously studying the phenomenon. Arctowski, bundled in a wealth of Siberian furs, is walking up and down the deck, ascending to the bridge and passing in and out of the laboratory, as if some great event were about to transpire. Racovitza, with a pencil in his bare hand, in torn trousers, and without a coat or a hat, comes out every few minutes and, with a shiver, returns to make serious sketches of the aurora and humorous drafts of the unfortunate workers in the "cold, ladyless south." These daily touches of humour by "Raco" are bitterly sarcastic but extremely amusing. Lecointe, lost in a Nansen suit of furs, has been out on the pack in his observatory, which he calls the "Hotel," and is particularly elated because he has succeeded in getting an observation. "Now," says he, "we will know when this bloody sun will rise." Our position is latitude $70^{\circ} 36' 19''$, longitude $86^{\circ} 34' 19''$. We are drifting north-

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ward and eastward; this we have already learned by the naturalist's drag-nets, but it is comforting to know the exact rate of drift. If we continue to drift northerly a little, if the temperature remains low enough to give a great refraction, and if the weather remains clear, the captain promises us a peep of the sun for a few moments to-morrow. This is the happiest bit of news which has come to us, and it sends a thrill of joy from the cabin to the forecastle.



H. Arctowski.

G. Lecointe.
The Four O'Clock Tea Discussions.

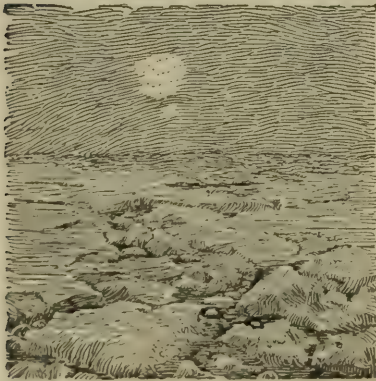
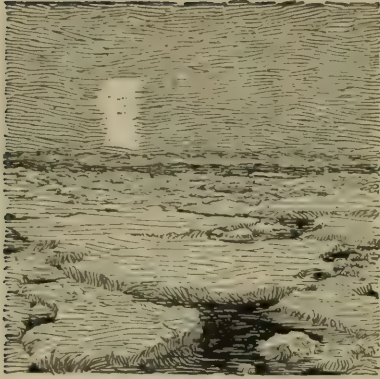
CHAPTER XXV

✓ SPRING—SUNRISE—TWILIGHT OF DAWN

JULY 22.—After so much physical, mental, and moral depression, and after having our anticipations raised to a fever heat by the tempting increase of dawn at noon, it is needless to say that we are elated at the expectation of actual daylight once more. In these dreadful wastes of perennial ice and snow, man feels the force of the superstitions of past ages, and becomes willingly a worshipper of the eternal luminary. I am certain that if our preparations for greeting the returning sun were seen by other people, either civilised or savage, we would be thought disciples of heliolatry.

Every man on board has long since chosen a favourite elevation from which to watch the coming sight. Some are in the crow's nest, others on the ropes and spars of the rigging; but these are the men who do little travelling. The adventurous fellows are scattered over the pack upon icebergs and high hummocks. These positions were taken at about eleven o'clock. The northern sky at this time was nearly clear and clothed with the usual haze. A bright lemon glow was just changing into an even

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Distorted Face of the
Rising Sun.

glimmer of rose. At about half-past eleven a few stratus clouds spread over the rose, and under these there was a play in colours, too complex for my powers of description. The clouds were at first violet, but they quickly caught the train of colours which was spread over the sky beyond. There were spaces of gold, orange, blue, green, and a hundred harmonious blends, with an occasional strip like a band of polished silver to set the colours in bold relief. Precisely at twelve o'clock a fiery cloud separated, disclosing a bit of the upper rim of the sun.

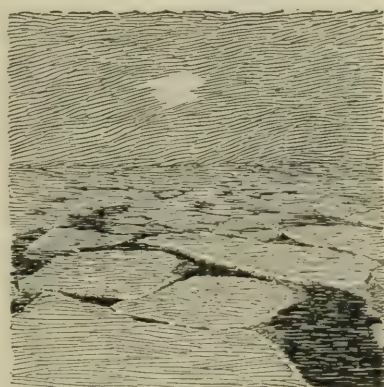
All this time I had been absorbed by the pyrotechnic-like display, but now I turned about to see my companions and the glory of the new sea of ice, under the first light of the new day. Looking towards the sun the fields of snow had a velvety

aspect in pink. In the opposite direction the pack was noticeably flushed with a soft lavender light. The whole scene changed in colour with every direction

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taken by the eye, and everywhere the ice seemed veiled by a gauzy atmosphere in which the colour appeared to rest. For several minutes my companions did not speak. Indeed, we could not at that time have found words with which to express the buoyant feeling of relief, and the emotion of the new life which was sent coursing through our arteries by the hammer-like beats of our enfeebled hearts.

Lecointe and Amundsen were standing on an iceberg close to me. They faced the light, and watched the fragment of the sun slide under bergs, over hummocks, and along the even expanse of the frozen sea, with a worshipful air. Their eyes beamed with delight, but under this delight there was noticeable the accumulated suffering of seventy dayless nights. Their faces were drawn and thin, though the weight of their bodies was not reduced. The skin had a sickly, jaundiced colour, green, and yellow, and muddy. Altogether, we accused each

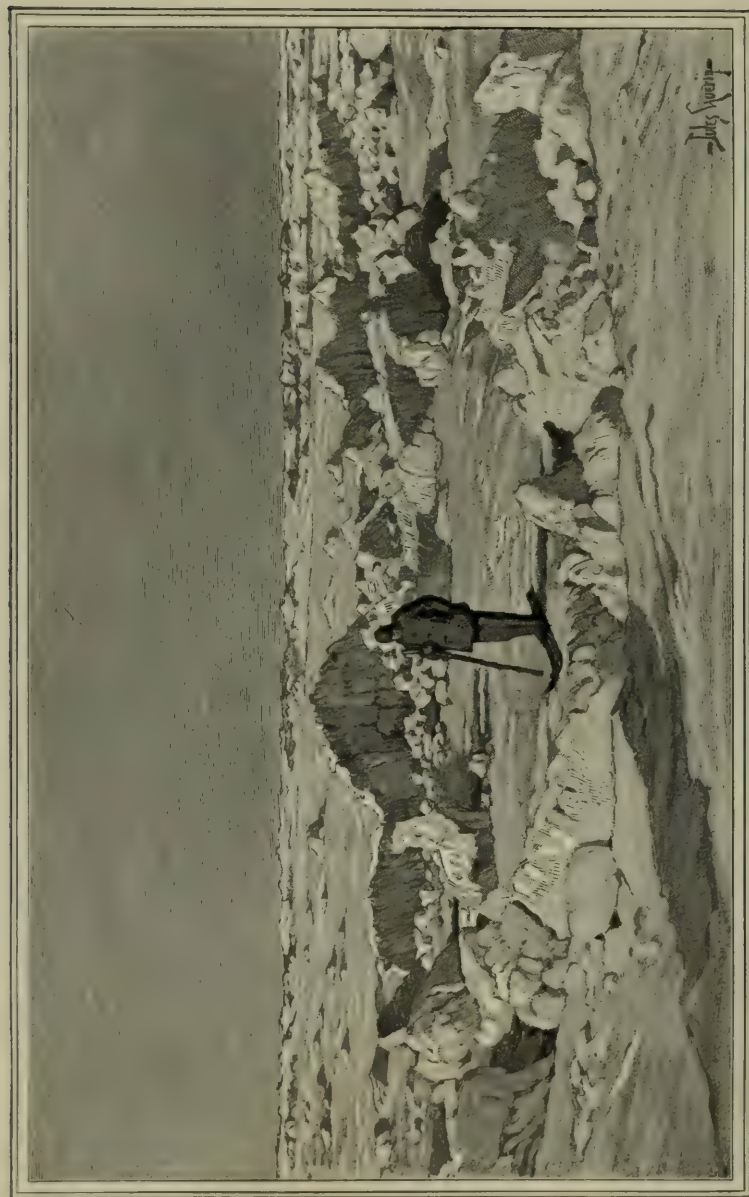


Distorted Face of the
Rising Sun.

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other of appearing as if we had not been washed for months. The uncertainty of our exact latitude made it impossible to estimate just how much of the sun's disk would be visible. Our time, too, was uncertain, for our pocket timepieces were not reliable, and we were far from the chronometers. We watched and watched, expecting that the crest of fire would rise and give us an increased glow of light and some heat, but it only slid teasingly on the verge of the sea. It seemed as though our world of ice was not yet worthy of the blessings of the "sun-god." A few minutes after twelve the light was extinguished, a smoky veil of violet was drawn over the dim outline of the ice, and quickly the stars again twinkled in the gobelin-blue of the sky as they had done, without being outshone, for nearly seventeen hundred hours.

July 23.—We have just finished breakfast, and at 8 A.M. are out on deck to welcome the promise of the coming day. It is long since we have taken such interest in the cold outer world, but we are now anxious to free ourselves from the darkness of the cabins, and the tiresome sameness of the daily routine of life. The meteorologist is reading the barometers and thermometers and recording the sky phenomena. The captain has just finished a magnetic observation. The crew are taking their usual hourly exercise by a brisk walk in a path about the bark. The officers are planning the day's work for the men to perform to-morrow. The scientific cranks are all scattered about the deck, shivering and noting matters of special interest to each. I took a short *ski* run out over the hazy purple ice to



Crossing Hummocks and Crevasses.
Edge of the Belgica Field in October.

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get away from the local drift of thought, and then reclined upon a hummock to study the scene. The temperature was -25° C., there was almost no air stirring, and aside from the life and muffled noise about the vessel, a death-like silence reigned over the entire scene. The *Belgica* was distinctly visible in the brightening twilight; her body was buried under the heavy weight of the accumulated winter snows, but the masts stood out in bold relief against a background of gold on the eastern sky. The masts and ropes and spars were heavily coated with hoar-frost, and they sparkled in the reflected glimmer of the dawn, as if beset by millions of diamonds.

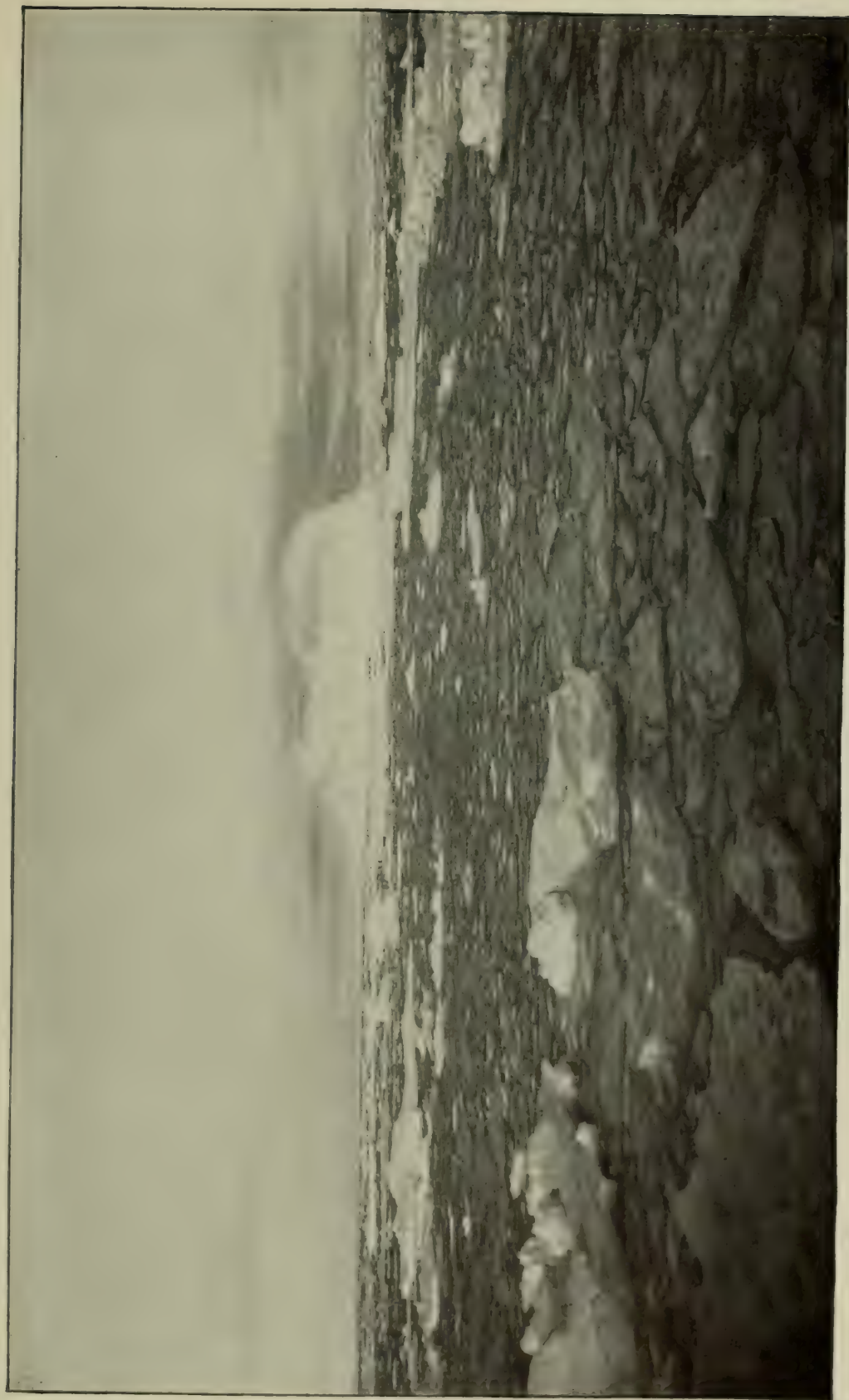
At a few minutes past eleven a wave of light spread over the vast expanse of the cold heavens, and then a gleam of fire burst through a large purple cloud on the horizon northward. The lonely spread of lifeless ice assumed a face of rose, and soon after, the entire northern sky was streaked with warm bands of carmine, but the sun was still partly under the surface snows at noon, and its face was twisted and distorted in such a manner that its globular form was not recognisable. Later in the afternoon we secured two royal penguins. During the night we saw and studied an aurora of the usual type. To-night the days of feasting end, and the freedom from routine work for the men ceases. The music-boxes and the accordion are forced to grind out music until late. We are playing cards and are having a joyous time generally in response to the stimulation of the few moments of noonday splendour.

July 24.—It is another beautifully clear day with

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a temperature of -34° C. What a blessing it is to have clear air and a clear sky during these important days when the sun is edging over the ice beneath which it has reposed so long. There is a bright blue twilight now at 7 A. M., and three hours later the light of dawn which shoots over the horizon makes the scene bright and day-like. Perhaps we shall see the real sun without refraction to-day; but if our latitude remains about the same as the last observation indicates we shall not have it over the horizon until to-morrow. There are many mirages on the horizon, inverted icebergs, raised ridges of hummocks, and bits of pack-ice, looking like mountains of some strange land. We played a game of whist to-night with unusual vigour. We have played a few hours each evening regularly, for several months, but up to the present we have all lost and won with about an equal measure of success; in the last few days, however, the luck has changed. Last night Raco won one hundred and fifty thousand dollars. To-night I won two hundred and fifty thousand. We are now satisfied with our success and in the future we shall decline all offers at whist.

July 25.—For three days we have had a glimpse of the sun, but it has appeared a thing of unreality. To-day we have seen the normal face. The sun at noon sailed along the northern sky above the horizon, a distance nearly equal to its own diameter. We thus have the actual sunrise, since heretofore we have only been able to see it when aided by the high polar refraction by which the sun is apparently



Edge of the Antarctic Pack.

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lifted above its actual position, a distance equal to about three quarters its diameter. What a peculiar effusion of sentiments the welcome face of the sun draws from our frozen fountains of life! How that great golden ball of cold fire incites the spirit to expressions of joy and gratitude! How it sets the tongue to pleasurable utterances, and the vocal chords to music! The sun is, indeed, the father of everything terrestrial. We have suddenly found a tonic in the air, an inspiration in the scenic splendours of the sea of ice, and a cheerfulness in each other's companionship which make the death-dealing depression of the night a thing of the past.

July 28.—An officer came in to-day, smiling and as happy as a child with a new toy, saying, "I can feel the heat of the sun," and at once everybody looked up as if doubting his word. We went out, and we stood in awe and amazement to drink in the first sensible sunbeams in nearly three months. To feel the gentle heat and to see the hopeful source which promised more, was a long wished-for pleasure and one whose intoxicating influence cannot be described. The men are journeying in pairs over winding paths on the pack; some drop here and there upon a convenient slope to sun themselves like snakes in spring; others sniff the air and run from place to place like bears.

July 31.—We have now so far improved in general health as to long for an extended outing,—a journey of several days' duration. This desire originates from an infusion of new life which revives our thoughts in response to the returning sun. The

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point selected for our first expedition is the great tabular iceberg in the east-northeast. All is hustle and bustle to prepare for this expedition.

During the last days of July the sky and the snow were flooded by a rich carmine light, which imparted a delightful warmth and charm to the cold blues of the pack. Soon after sunrise, however, a smoky mist of frost gathered over the icefields and smothered the new glory of the sun, absorbing most of the colour, all of the heat, and leaving only a dull coppery-red misshapen ball. Many of us were now anxious to get away from the monotone about the ship as quickly as the weather would permit. We were tired of the "mad-house" promenade about the bark. The little mountains of tin cans, ashes, and other *debris*, which decorated our immediate surroundings, were wearisome. The great drifts of snow, over which we now marched from the deck, though picturesque, were painful to the eye because for many long weeks we had dug paths through, and tunnels under, the same snow. We felt that if we could get away for a few days and pitch our camp upon the bare bosom of the sea of ice near some iceberg, we might make some studies worthy of record, and we would certainly come back loving the *Belgica* and our companions better.

To this end we have devoted much of our time during the stormy days. It is found that for serious travelling over the pack almost all of our equipment needs re-modelling. I have begun with the clothing. In addition to my furs there are but four skin suits on the *Belgica*. Sufficient experimental work has

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been done to prove that in the cutting winds, and freezing temperatures of the coming months it will not be safe to venture far without furs. Woolens sufficiently heavy to be comfortable are too cumbersome. Three of the suits are made of Siberian wolf skins, after a pattern suggested by Nansen, but the model is such that we find them worthless, except for work in the observatories. Nansen has improved the Eskimo pattern in a manner which makes the suit much warmer, but having omitted the vital point in the construction of polar garments, that of ventilation, the costume becomes useless for active work. We have worn it in short *ski* runs of thirty minutes, in temperatures of -20°C. (-4.0°F.) and each time we have come back wet with perspiration. Finding Nansen's improvement a failure, we have reduced the suits as nearly as possible to the aboriginal style. Arctowski has a Yakouts suit from Siberia, which has undergone a similar transformation. Both the Nansen and the Siberian outfits are excellent for riding or work which requires little exercise, but for travelling over the pack the furs must be less cumbersome and there must be a freer ventilation. The sailors have been provided with canvas cover garments cut similar to the Eskimo fur suits. These are excellent wind guards, but are of little service in confining the bodily heat. We have devised a similar covering made of blankets which is worn under the canvas, and this seems to keep the men comfortable for their ordinary outside work. But the combination is much more troublesome than an Eskimo fur suit and decidedly inferior for active work.

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In view of our prospective work of endeavouring to explore the pack, and any new land to which the drift might bring us, we deemed it necessary to devise some kind of tent for shelter. We had but one tent, and, like many other things intended for polar work, this had been so improved that it was useless. This was also modelled on Nansen's plans, but its improvement consisted of a coating of waterproof material suggested by a friend not familiar with polar work. This water-proofing so hardened in the cold that the cloth cracked, and was torn with the first storm of summer. The difficulties with all ordinary forms of tents are that they are too heavy, too complicated, and will not stand the strain of polar storms. We have tried to build one which would overcome as much as possible the faults of others, and our result has been gratifying. For several weeks we all studied the subject, and I dare say that we have among us more ideas bearing upon the construction of tents than ever before existed among a bunch of men. It is unfortunate that we have not the time to put all the plans into execution. The doctor's tent design was accepted by Amundsen and at once the cloth was cut for its construction. We worked upon this for about two weeks, and then, proud of the result of our own skill, we placed it for exhibition and criticism on the pack. The tent was made large enough for three occupants. The main points kept in mind in devising the plans were lightness, durability, stability, and ease of erection. I will not here describe the faults of other tents nor the excellence of our

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own invention. The accompanying photographs illustrate our model. Suffice it to say, that this which we have styled the "Antarctic tent" weighs but twelve pounds, will withstand the worst storms, and can be set up in a strong wind by one man in five minutes.

No extensive sledge journeys had previously been made over the pack by us, nor, indeed, by any one else so far as history knows. Hence, everything about this prospective jaunt was experimental. Our specific destination was to visit a great tabular berg, which we estimated was about sixteen miles away. The project took its origin from various discussions as to the possibility of making long journeys over the pack. Commandant de Gerlache held that it was possible to travel safely over the pack two or three degrees southward, but nearly everybody else opposed this view, because of the absence of any station or land to which one might retreat in case the vessel was lost which, with the local movement in the pack, might easily happen. There were many volunteers for this venture, but there was room for only three in the tent, and altogether this is the most appropriate number for such a trip. The party was limited to Lecointe, Amundsen, and the writer. We arranged a sail for one of the American sledges, and loaded it down with fuel and provisions for ten days. The selection of the food stuffs had been left to our own judgment, and we were ungenerous and selfish enough to select only favourite relishes.

CHAPTER XXVI

THE SPRING (CONTINUED)—RETURN OF LIGHT— A SLEDGE JOURNEY

THE morning of July thirty-first opened with a golden glow northward, and a fair but cold wind, driving the hard crystals of snow over the crust with a metallic ring. The weather for several days had not been promising, but on this morning the barometer was steady, the temperature -34° with a fresh breeze from the south. The meteorologist assured us that the signs promised excellent weather. We have learned to take the official weather forecasts with an air of disbelief. Still we started; the sledge was put on the ice, the bundles of food, fuel, furs, tent, etc., were tossed on the snow, and quickly our sledge was snugly loaded, and a sail set to a fair wind. The sail helped us much; its force was equal to that of one man. The surface of the ice was fairly good for sledge travelling, a thin crust on the top offering little friction to the sledge, and generally the runners did not break through. Such a condition was found on the larger pans upon which there were small snow-covered hummocks, from one

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to three metres high here and there, but around these we could always find a passage.

Physically we believed ourselves in fine trim. Every moment of sunlight had been used by us for exercise. We had been on a forced diet of penguin meat, and had undergone the baking treatment to bring our strength to the maximum. We were, however, far from normal, though our ambitions, like the spring flow of rivers, were no longer to be confined to ordinary bounds. Our real difficulty began when we left the large old fields to cross the young ice of leads. Here were huge ridges of pressure-lines all nearly impassable, and the little valley-like spaces between were covered by beds of dry snow in very small crystals, over which a sledge runs about as easily as over sand. Another disheartening series of regions, were the sites of recent leads and lakes over which it was necessary to pass. These were sheets of water thinly covered with ice from three to six inches in thickness, and coated by a most beautiful fur of hoar-frost. The nearness of this to the level of the water, and the great difference between the temperature of the water and that of the air kept it constantly humid. An evaporation rose from this new ice as if water were boiling under a screen. The mixture of water with cold snow offers a surface over which a sledge slides with the greatest difficulty. There are several methods of overcoming this resistance. One method is to shoe the sledge with ivory or whalebone, or what I like fully as well, penguin skin, but for this we were not prepared at the time.

At a distance of about a mile from the ship we

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stopped to take compass bearings of her and the surrounding icebergs or landmarks. The scene here was a picture for the gods. In the north the sun, a great yellow ball of fire, was gliding westward along the horizon, laying beams of gold on the endless sheets of white of the pack. The moon, nearly full, a bright globe of frosted silver, floated high in the eastern heavens. The sky was, here and there, thinly veiled by stratus clouds formed by the ever-present microscopic specks of snow which float about in the antarctic atmosphere. The colours above were not rich but restful, and on the frozen bosom of the sea there was a charm which cannot be made to flow under my pen. The surface was everywhere rough and ragged, the line of horizon in some places looking not unlike a profile of ruined, marble buildings. The many, rough edges of blue hummocks, the thin plains of green and yellow, young ice, the clear-cut edges of icebergs, with walls assuming various colours, according to the amount and kind of light absorbed, made a dreamy, fairy-like scene.

Before us, apparently within gunshot, was our destination, the great tabular iceberg, its deceptive nearness urging us on to action, and offering us the hope to be able to camp in the lee of it before night. But in reality it was not less than sixteen miles away. Behind us was the little *Belgica*, the only speck of human life in this rolling sweep of the great south frigid zone. How little and insignificant she seems amid these huge sheets and mountains of ice! Yet upon her stability, upon her power to fight and resist



The Midnight Sun Over the Pack-ice.

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the awful attacks of the storming rams of ice, depends not only our comfort and success, but our lives. We travelled in perfect comfort and with much ease, two on *ski*, and one on disc snowshoes to push and guide the sledge. The sun sank under the horizon at about two o'clock, the moon which had been visible all day now assumed a more hopeful face, and little by little the dark-blue twilight circle rose on the southern sky. In the twilight it was difficult to see the hummocks, the crevasses, and the weak sheets of ice. When we began to think of a site for a camp we were, apparently, no nearer our destination after the day's march of seven miles than when we started. At this time we saw a small smoky discoloration on the sky ahead of us, from which we concluded that water was not far off. A little later, we came to a lead covered with new ice over which we crossed to a very rough peninsular of old ice. From here we saw first a line of greenish yellow ice, which we have learned, by experience, is usually not strong enough to bear the weight of a man; then we saw a black line of open water beyond. After a little careful observation we were able to distinguish many whales and seals in this lead.

Our course being directly across this break in the ice, we decided to pitch the tent on the nearest floe which offered a solid bed. This lead had a general direction from east to west; it was about one mile wide at its narrowest points, but in other places there were expansions of from two to four miles. A good floe was found to be south of this, and our site for

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camping resembled in many ways the margin of a large river. The old ice with the ridges of hummocks offered an elevated bank. In the centre were fragments of ice, floating about like the winter ice of a stream. It was a real joy to pitch the new tent, after our experience with the ill-adapted old ones. In less than three minutes it was set, and a fire was in progress for a needed meal. The temperature was -20° C., and a strong breeze came from the south, but even with these atmospheric conditions we were comfortable in our shelter.

It took us a long time to prepare our food—about six hours;—everything which contained water was frozen to the consistency of stone, and to heat this, or indeed any kind of food, the Jackson apparatus, which was the only stove we had taken from the ship, was inefficient, while its consumption of alcohol was, in our experience, so wasteful that its use as an item of polar equipment is injudicious. It took us about two hours to thaw out some penguin steak, and two more to make a soup which has the enchanting name of "*bonne femme*." In this we managed to mix a liberal supply of reindeer hair, penguin grease, and other flavouring material. The soup was a failure,—but not quite so much so as the chocolate prepared shortly after. This was made in a can in which the penguin steak had been warmed. It contained, besides chocolate, milk and sugar, much butter, penguin oil, blood, and pieces of fishy meat, some "*bonne femme*" soup, and reindeer fur. Leconte, who had the honour of having the first cup, received, besides the major quantity of oil, the lighter



Ice-Flowers.



The Assembled Discs of Ice Crystals which give Origin to Polar Ice.

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floating material. He pronounced it "scandalous!" But the other victims who tried it praised its nutritious qualities very highly. After our feed we stowed ourselves away in our bags, falling on each other's stomachs, as our efforts to reach the bottom failed. Finally we went to sleep while the wind roared and the snow dropped on our tent, making a sound like bits of metal; a music which, when comfortably stowed in our bags, proved restful and conducive to sleep.

We arose the next morning complaining somewhat of the cold, but this is the grievance of every first encampment. After three hours of cooking, chocolate was prepared, and with it we ate alpine biscuits. This was quite sufficient for our morning meal. Then we crawled out of our bags, took our furs from the snow under the bags, shook the snow out of them, and quickly dressed. Once in our travelling garments, though frozen and filled with fine dust-like snow, we soon felt comfortable and dry. Emerging from the camp we saw the sun about fifteen degrees east of north and close to the horizon, from which we concluded it was eleven o'clock. Our watches had refused to tell the time in the cold. The day was not promising, the sun was screened by an increasing mist and the horizon was everywhere indistinct. The pack was gray, and the leads black with many smoky zones on the sky, indicating a disruption of the ice and much pack movement. We were permitted a look at our projected journey's end, the tabular iceberg, and from our position the way to it seemed simple enough. Its distance

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from us was about nine miles ; it was 2,000 feet long and from 250 to 300 feet high, with a smooth upper surface and vertical cliffs; along the base, on the two sides visible to us, was a huge ice fort about 50 feet high and 100 feet wide. On this were fragments of ice mostly covered with snow, giving it an appearance of a smooth terrace. Here and there were huge fissures visible only at the top, and widening into a valley towards the base. These valleys were strewn with ponderous boulders of ice. There was no evidence of fresh fissures, no blue lines or stratas; everything wore a homogeneous mantle of unblemished purity.

The lead before us proved, on further examination, an impassable barrier for the time. It extended as far as the eye could penetrate to the east and to the west, a great polar river in a mid-polar sea of ice. In it were hundreds of whales, finbacks and bottle-noses, and countless seals, Weddell sea-leopards, and crab-eaters, but strangely enough no penguins. The new ice forming was not of sufficient strength to bear our weights, hence we returned to the tent to prepare our dinner, the last meal of the day. When it takes six hours to prepare one meal, one does not provide more than two, and in actual practice that is found sufficient.

Finding that to cross the lead was quite impossible for a day or two, we decided to build a snow-house which is always preferable to a tent for a long stay. This was the second snow-house which we built in the antarctic, and the first in which men lived. It was constructed on the Eskimo model,



An Iceberg Held by the Ensnaring Influence of the Pack-ice,
Forming the So-called "Barrier."

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conical in shape, like a bee-hive, with circular lines of blocks, each circle decreasing in size until the top, which is small enough to cover with one or two pieces. The Eskimo does this with an ordinary knife or a crescent-shaped instrument, made from a walrus tooth; but this requires much dexterity and some experience. I have always found that a small saw was better adapted for the purpose. With this, one can improve on Eskimo methods and build a much stronger *igloo*.

We selected a bank of driven snow with a hard consistency. To get a working edge here we first made a straight cut, then a slanting circular incision, raising the crescent out in pieces. Then we sawed another groove parallel to the first and cut this strip into blocks of a size easy to handle. Finally we passed the saw under the surface at the desired thickness, after which a slight touch from the hand or foot separated the block. There is no rule as to the size of the blocks; they must be cut according to the strength of the snow. Usually blocks one foot thick, two feet long, and eighteen inches wide are the most convenient. These can be transported on a sledge to any desired site for the *igloo*. Such a place is never far off. The man who builds the wall must be careful that the blocks of each succeeding circle will centre on the lines of meeting of the blocks below, a law well known in masonry. He must endeavour to keep the surface of the wall from sloping in or out, and every piece must rest firmly on each of its neighbours. When the *igloo* is finished there will be found many holes between the

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blocks, but these are easily filled from the outside. The door should be cut after the structure is erected. If the *igloo* is intended for a continued residence, a low arched entrance is necessary to keep out the sand-like blasts of fine snow.

Our sojourn in this particular house was very agreeable. It was an experience which I shall long remember. We placed the sledge sail on the snowy floor, and on it our sleeping bags. The only culinary articles which we used were fixed in terraces on the wall, or simply driven in the blocks. To undress and get into our bags in this house was an easy matter. Taking off everything but our underwear, we placed the travelling suit, including our boots, under the bags, and without more discomfort than a little snow down our backs we slid into the zenith of polar comfort, the sleeping-bag. The scene outside was dazzling beyond description; the scene inside was restful beyond all expectation. Through the crevices of the dome the sharp, silvery rays of the moon pierced and played in quivering beams and zones of colour. The pale blue sky, with its wealth of starry gems, was visible from one or two positions. A brisk, cold wind drove a little snow into our *igloo* and over our beds, but this did not disturb us. We wrote, read, and played cards by the aid of a candle, and at a time which we guessed to be eleven o'clock, we fell asleep.

August 2.—We did not awake until about nine o'clock to-day. Breakfast was prepared while we made a hasty examination of our situation. The horizon was obscured by a light fog; it had snowed



Arctowski.

Lecointe.

Racovitza.

Gerlache.

The Midsummer Christmas Dinner.

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a little during the night; the lead was separating, and zones of water-sky were noticed in nearly every direction. These prospects forbidding a continuation of our journey, we packed up for the return. Many seals appeared on the ice as we left, and some came over to our camp as if to say "good-bye." We did not molest them. The ship was not in sight when we started, and we knew by its changed position yesterday that there was considerable motion in the ice, enough to make the actual direction of the *Belgica* somewhat doubtful. The light was dull and diffused, making it impossible to observe hummocks and drifts; a fact which caused constant stumbling, and the destruction of one pair of *ski*. We tried to take a compass course, but this was difficult because the light was too vague to make hummocks or landmarks discernible. Many ill-defined, smoky figures of clouds, generally oblong, were on the sky. These indicated the disruption of the ice and an exposure of bands of open water, which we were soon to locate definitely, with much disappointment and discomfort.

As we advanced we heard whales spouting on all sides, but could not yet see them or the open water in which they gambolled. A little farther on we saw many seals, and soon after a belt of ice fissured in every direction. Thinking that we could cross this we strode over one pan after another, expecting every moment that we would reach more solid ice where we might pitch our tent for the night. The darkness advanced, and the pans separated more and more. Soon it was perfectly dark. The ice

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was so black that we could not easily mark the difference between it and the waters. To proceed was now impossible, and to camp on a little pan, the centre of a great pressure angle, was not conducive to rest, but we had no other choice. In a few moments our tent was pitched, and light within offered a spark of cheerfulness, but everything outside was as dismal as it could possibly be. The wind blew with a despairing howl, driving snow into every opening or seam of our fur suits. The ice groaned and cracked, and complained of the pressure forced against it; our floe was little by little reduced in size until we could hear the seals in the water as plainly as if they were under the tent. I cannot imagine a position on the polar pack more hopeless. We were tired and knew well that we would sleep, and perhaps not awake until dropped into the cold water. To overcome this danger we kept watch.

The seals during the night came upon the ice to examine our tent, our *ski*, and our sledge; but evidently these were not to their liking, for they went away, and played and gambolled like children on the end of the floe. Whales also spouted all around us, and the wind brought their spray onto our tent in icy globules. About four o'clock in the morning the pan broke within two metres of the tent, and we expected momentarily to see an opening in our floe. Dawn came at last, but the atmosphere was again too obscure to permit a hope of an early advance. We thought we could see more firm ice south of us and made an effort to reach it, but we

Before.



Frederick A. Cook.

After.



Frederick A. Cook.



Roald Amundsen.



Roald Amundsen.



Emile Racovitza.



Emile Racovitza.

(We were all reasonably good-looking when we embarked, but we were otherwise when we returned.
The long night effected a radical transformation in our physiognomies.)

ANTARCTIC NIGHT

only mounted the neighbouring pan. From here all further progress was stopped by black bands of open water. We pitched our tent again and prepared some hot food and drink. The mist was so opaque and so much fine snow was drifting that it was impossible to see more than ten or fifteen metres. Occasionally there appeared bright spots in various directions, and in these we thought we could distinguish familiar icebergs, but they always proved to be only small hummocks at a short range.

In the afternoon the wind came out of the south and cleared the air. We now saw the *Belgica*, and also men coming in our direction. This gave us great pleasure. The ship was not more than a mile from us, and the men soon reached a floe south of us, but they could not gain our floe. Van Mirlo made a desperate effort, but slid into the water and nearly lost his life. We ate a hearty meal, then again crept into our bags. For this night it was not necessary to keep a watch, because the pressure had ceased and the temperature was falling rapidly, protecting our pan by one of new elastic ice; but a knife was kept ready to cut an opening for our escape should the ice suddenly separate under us. The night was one of comparative quietness.

We arose early the next morning,—about 8 A.M.,—prepared breakfast, and at noon were ready for a desperate attempt to get to the vessel. We left the tent and most of the equipment behind, but took on our sledge enough food and our bags, in case it became necessary to make another camp. Using the sledge as a bridge, we succeeded in crossing the many leads

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and crevasses and reached the *Belgica* about two o'clock. She seemed now a big ship full of comfort and rest. It was nearly two weeks before the ice was sufficiently formed and packed around this pan to permit a removal of the tent.

The month of August was, on the whole, one of the greatest disappointments of our experience in the antarctic. We expected low temperatures and bright, cheerful weather. With the coming sun we hoped to dispel our anæmia and make ourselves ready for a series of difficult tasks to be undertaken in September and October; but instead we failed more and more in strength, and developed alarming mental symptoms. One man was temporarily insane, and several others were nearing a similar condition. The weather was stormy, the atmosphere was charged with clouds of sand-like drift-snow, and the sun was almost constantly invisible, though it rose higher and higher and swept more and more of the horizon daily. For one month following sunrise, like the month preceding its departure, the conditions were in effect a part of the night. It is true we had a little misty grayness at noon which we called daylight, but this was counterbalanced by the never ceasing tempests which drove such a blast of cutting snow that life outside was impossible. The first glimpses of sunlight had aroused us to new ambitions, and to spasmodic spells of cheerfulness, but this hellish series of storms sent us again into the most abject gloom of the night.

The last week of August and the first two weeks of September was the coldest period of the year. At

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this time the thermometer ranged steadily from -20° C. to -43° C; the lowest temperature of the year, -43° C., being recorded at four o'clock in the morning of September eighth. The lowest average for any one continuous month was in July, -12° C. From the minimum on September eighth, the temperature rose rapidly to $+1^{\circ}$ C. during the week following, which was a point within a half degree of the maximum of the hottest weather of midsummer. We thus had our coldest and our warmest weather in the month of September which, in the cycle of the seasons south, is similar to March of the northern hemisphere. Great quantities of drift-snow were driven over the ice at this time, and the air was so charged with crystals that halos of the sun and moon, and parheliases and paraselenes, were of almost daily occurrence. The ice was now the most continuous of any period of the year. The limit of the field in which the *Belgica* was held was not visible from the masthead. From the crow's nest it was always difficult to determine the edges of the fields, because the raised pressure ridges made the cracks and narrow lines of water beyond invisible. We were, however, easily able to locate some wide leads, and the almost constant smoky vapour, which rose over fresh breaks, made it possible to determine even small cracks.

We have made the subject of finding open spaces of water a special study. Such knowledge is part of the acquirement of an antarctic hunter. An inexperienced wanderer will walk over the pack day after day until his eyes are blinded by the dazzling blink of the ice before he finds a trace of life; but an adept

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will adopt the methods of the penguin or the seal, who, when stranded on a field with the blow-hole closed, will mount a hummock and scan the horizon to find the jets of black vapour which rise from open spaces of water. We have to go a long distance now to secure game to replenish our larder with fresh meat, which is, at present, almost our sole diet. The life at best is very scarce, and to find it we must roam over the ice for several miles. With a revolver in our pockets, and a sheath knife at our sides, we go about daily from crevasse to crevasse, eagerly looking for penguins and seals. As a rule we are fairly successful; at any rate, the table is liberally supplied with fresh steaks.

CHAPTER XXVII

SUMMER

October, 1898.



Snow-Goggles.

IT is but slowly that this blackness of the polar night is dissolved by the whiteness of the coming day. Until the first weeks of September we felt little of the cheering influence of the rising sun except for short, spasmodic periods. The human system accommodates itself sluggishly and poorly to the strange conditions of the polar seasons, and we, too, are slow in adapting ourselves to the awful despondency of the long winter night. It is possible to close your eyes and befog your brain after a time, when all the world is enveloped in prolonged darkness, but this is not physiological adaptation; it is abnormal education. We have all felt the effects of the night severely. The death of Danco, and also the insanity of a sailor, are due to this withdrawal of light. Now that the light is brightening every day, we are as backward in recuperating as we were in establishing a balance of living comfort dur

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ing the vanishing dawn of the early night. The present cheering influence of the rising sun invites labour and frivolity. The soothing light of the long evening twilights invites repose. The change from day to night and from night to day, so long absent from our outlook, is now beginning to lighten the burdens of the weary mind and the aching muscles; elevating the depressed spirits of hope, augmenting the dwarfed courage, and raising the moral perceptions to the great life battle of work before us.

We have talked only of the discomforts of the night, and of the misery. The long unbroken darkness has not totally blinded us to its few real charms which are strikingly brought out by the awful contrasts of heat and cold, of light and darkness. As lovers of Nature, we found many pleasures for the eye and the intellect in the flashing aurora australis, in the play of intense silvery moonlight over the mountainous seas of ice, and in the fascinating clearness of the starlight over the endless expanse of driven snows. There was a naked fierceness in the scenes, a boisterous wildness in the storms, a sublimity and silence in the still, cold dayless nights, which were too impressive to be entirely overshadowed by the soul-despairing depression. The attractions of the polar night are not to be written in the language of a people who live in a land of sunshine and of flowers. They are found in a roughness, ruggedness, and severity, appreciated only by men who are fated to live in similar regions, on the verge of another world, where animal sentiments take the place of the finer, but less realistic human passions.

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From May 31, when we were in latitude $71^{\circ} 36'$, a point farthest south, to September 16, when we were in latitude $69^{\circ} 51' 16''$, we steadily and persistently drifted northward. The movement has been extremely slow, and at times we have been stationary, but we have not gone south with northerly winds. This we explain by the fact that new ice forms rapidly in the leads which open behind us, thus closing all the spaces. In a similar manner, but with many more interruptions, and with a much more rapid pace, we have drifted eastward during this time from longitude $87^{\circ} 33' 30''$ to $82^{\circ} 22' 45''$. The longitudinal drift, however, has changed with every direction of the wind. From this time until November 19, we drifted southward again, while still continuing our easterly drift.

October 15.—We are now able to read our thermometers and other instruments outside without artificial light from 2:30 A.M. to 9:30 P.M. The five hours of night are made so brilliant by the twilight during clear weather that we can read ordinary print all night. We no longer need lamps on board during the day, which is fortunate, for our stock of candles and petroleum is getting low. The snow in the night now assumes a noticeable brightness after a day of sharp sunshine. During the long night, and in the early days of spring when the sun was feeble, the snow was dull and black. The present change to a sort of phosphorescence I have ascribed to a kind of latent retention by the snow of the light of the sun. I have taken much interest in this phenomenon, and have recently made certain tests which seem to confirm

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my theory. For a number of days I have placed black cloths over certain smooth fields of snow. During the night I have removed these and invariably there has been a dark spot, corresponding to the size of the cloth, while the snow everywhere else was semi-luminous. This, in my estimation, proves that the snow absorbs and retains for a time certain rays of light.

There is now considerable life, but we must go far to find it. The leads are several miles from the ship. When we get to them they seem like huge endless rivers, winding through a white plain. On the banks are lines of pressure ridges, from two to twenty feet high. In these spaces of water are some freed icebergs and a few small pans of old ice; but the low temperature soon covers every bit of open sea with an even sheet of new ice, through which the whales and seals must force their blow-holes. Nature favours them by breaks here and there; but the steady, calm, cold weather of the present is opposed to much ice-movement, which accounts for the few breaks. All of the seals which have been seen since the months of April and May are crab-eaters (*Lobodon Carcinophaga*). They seem to travel in groups of from two to ten, and they follow the leads southward after every storm. The whales do the same, and when the new ice forms, and the retreat is cut off, they seek the regions about the icebergs where the retarding influence of the bergs in the drift causes enough commotion to keep spaces of water open. Failing in this, they break through the new ice by forcing their heads through it. It is a curious



An Old Wind-swept Hummock.



The Sand-like Drift Snow.

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fact that, up to the present, we have seen only finback whales (*Balaenoptera Sibbaldii*) in the pack, but now we find an occasional bottlenose (*Megaptera Boops*) in the little lakes and streams. The convenience, which the whale and seal holes offer, made us think that perhaps penguins might utilise them as breathing spaces, but this never happened so far as our experience went. Penguins, being better able to move over the ice, have a wider range of habitation, and they always use open leads.

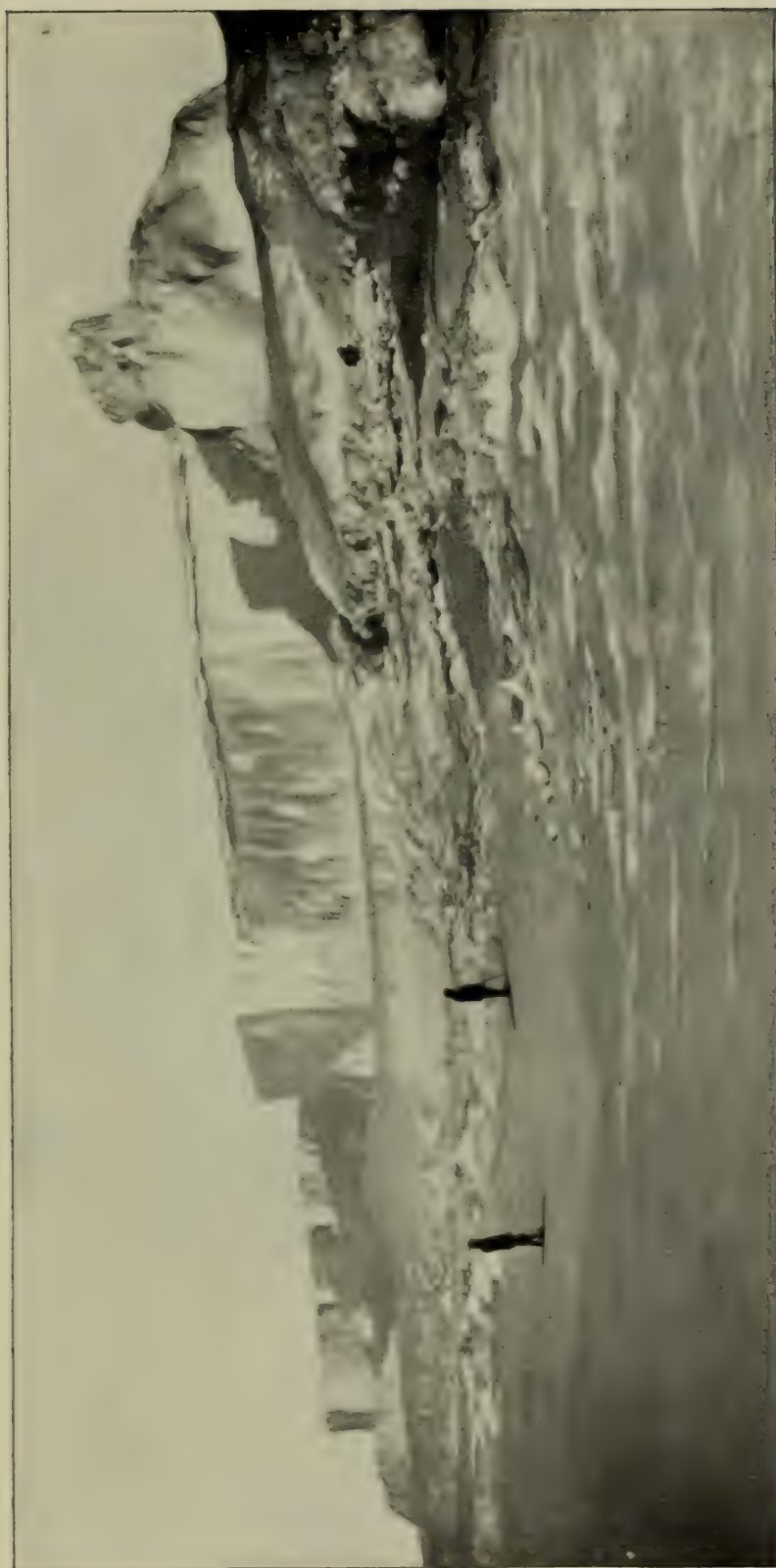
The weather, the ice, and the general life and surroundings have been so monotonous for the past month, that I have found little of interest to tabulate. The general health of the crew is improving. They no longer have an anxious, dejected aspect, and their spirits are rising. In clear weather they sing, and dance, and speak in happy, cheerful tones. The ship is being prepared for sea, which is a matter of considerable work. Being imprisoned in the grasp of the pack for these many months has made the locality like a small village. Out-houses, sledges, sounding machines, and many other things are strewn on the pack. Aboard, the fixtures have all been more or less disarranged, so that everything must be restored and refitted for the new voyage. We have filled the water-tanks with snow. By burning seal blubber and coal in our condenser, we are able to melt snow and bring the resulting water to a boiling point very quickly; this is poured over the snow in the tanks. This method is very satisfactory, for in this way we are able to make several hundred gallons of water daily. I believe, how-

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ever, that a jet of steam directed into the tanks would do the work much more quickly and with greater economy ; but to make the necessary alterations for this is, with our equipment, quite impossible.

Could there be a more melancholy, a more maddening, or a more hopeless region than this? We are passing rapidly into the polar summer, the time when, in other zones, all Nature smiles ; — even the sister zone, the arctic, has striking attractive features at this time. The birds fill the air with music, new animals make their appearance, and on land even flowers and mosquitos serve to make life interesting ; but here, in this icy antarctic wilderness, the charm of Nature is dead. We see the sun so seldom that it is, indeed, a surprise when its unobstructed rays fall upon the frosted whiteness. Though it sweeps more than half of the horizon daily, we get only the cold blue light which is filtered through a constant haze of icy clouds. An occasional sunburst for a few moments each day and a clear sky once fortnightly is our average. Storms, tempests, and steady howling winds with snow, are our constant lot, and these come from all points of the compass. There is no inspiring solitude, no rest, no cheerful outlook ; the sea is imprisoned under a restless and irregular mass of storm-driven ice. The sky is always cloudy and dirty ; the air is always wet, cold, and agitated ; under such circumstances the human mind assumes a like attitude.

For two days we have had a fierce gale veering from south-east to south-west ; an excellent direction to send us north at a rapid pace, which is a pleasant



The Tabular Iceberg, the Largest Berg within the Horizon of the *Belgica's* Drift.

It is about 200 Feet High, and a Half-mile Long.

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consolation for the ill-effects on the spirits and on the personal comfort. The storm is, of its kind, the worst I have ever seen. The wind is strong, but one could hardly call it a tempest; it brings with it, however, all the elements of misery which follow a tempest. The air is so loaded with very fine snow-crystals that its action upon the face is something of the nature of emery paper. This snow is blown in gusts and constant streams, which scrape and rasp all projections, and bury every declivity, while the snowy surface is cut into small ridges which we call *cestrugi*; and around the *Belgica* it is deposited to such an extent that nothing but the masts are visible. A very strange accompaniment is a perfectly cloudless blue sky at the zenith, while all along the horizon there is an opaque circle of icy haze, which is tinged with the most delicate hues of red, blue, and yellow. One can nowhere see more than 100 metres, yet this haze seems far off. It is, of course, the driven snow which causes this phenomenon, and also a nearly constant parhelia; but the fact that the sky above is perfectly clear proves that the obscurity is very low on the ice, perhaps not more than ten metres, for the topmasts of the ship are visible above it, and now and then the tops of icebergs also appear. The picturesque effect of this hurling, seething confusion of icy crystals is far beyond my power to paint in words. It is a picture at once full of incomprehensible grandeur, indescribable discomfort, and irresistible attractiveness. But who will tabulate this with enthusiasm when snow is being driven down your neck, into your eyes, ears, and almost into the

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pores of your skin, while your boots, your mittens, and every opening or fold of clothing are filled with snow at a temperature of -20° C.? Who will paint the colours, or sing the joys of Nature, when the wind pipes the notes of a buzz-saw, and will not permit you to stoop without helping you to a sommersault?

The Commandant gave us a new programme yesterday for the summer campaign but we do not now regard programmes seriously. We think more of the many little things which cause life to fall and drift and settle into our boots, like the snow around us. Indeed, there are but few things greatly interesting, except the character of our food, the prosecution of our special work, and the prospect of our release from the iron grasp of the rigid pack.

I have heard of a deaf man who once said that life was of value to him only because of "reading, eating, drinking, and the prospect of death." This sentiment in a modified form would, I am certain, be the confession of many, if not most, of our party, during every stormy period. The modification is, perhaps, only in the last word, and this we would change to "the prospect of an early return to the inner world and to renewed social conditions." The storms are so numerous and close that a tempest is nearly always on the horizon. If it is not so, as was the case a week ago, the air about the *Belgica* rings with happy voices and musical sounds. But there is always something to make hilarity short-lived. If it is not the weather it is a frozen batch of skins, a garment hopelessly torn which needs mending, a watch to repair, a boot to mend, a camera

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to alter, or any one of a thousand discomforts and distractions about the ship which send the soul to the verge of desperation. To-night I have stockings to darn, to-morrow pantaloons to mend, and all of next week carpenter-work, mending and making sledges, sewing sails, dressing skins, and taking photos in a temperature -22° C.—all of this is far from pleasant, but it contains a lesson. It teaches us how much of the drudgery of life is done uncomplainingly by mothers, sisters, wives, and other members of the family circle. It makes us feel the importance of feminine existence, causes us to see the ups and downs, the ponds and eddies, the rapids and cataracts of the humdrum side of life which man ordinarily escapes.

November 16.—The winter night, with its death-dealing blackness, has passed; the spring, with its awful storms and gray monotony has followed, and the summer, with its continuous noonday splendour, commences to-day. At least it ought to, if our estimated position is correct. We have, however, had no observations in a week, and are not, in consequence, able to fix our exact position, and the persistent cloudiness of the sky is such that we cannot determine whether the sun is above or below the horizon at midnight.

November 25.—Latitude $70^{\circ} 25'$, longitude $83^{\circ} 27'$. For more than a week the sun has sailed around our heavens without setting, and thus we have entered upon our summer nightless days. We should have seen its warm glow at midnight and at mid-day, but we have not seen it at all, not even for one hour, during this time. By this I do not mean

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that it is dark ; in fact, it is quite the contrary. It is too light. The sky has been constantly lined with thick clouds, and there has been an endless period of fog and snow ; but under all of this opacity the light, by refraction from the cold mist and by reflection from the dazzling whiteness of the unbroken snow, has been so great that all who have not worn goggles have complained of incipient snow-blindness. At night, or during the sleeping hours, the men are compelled to hang black cloths over the ports to gain sleep and rest from the diffused, piercing light. Nearly every one is suffering, more or less, from insomnia, and the cases which have been mentally deranged before show new signs of disturbance. Thus, though the light, even during cloudy days, is too strong for our eyes, and at night too piercing to permit sleep we long, with an intensity impossible to describe, to see the unobscured face of the sun, and we hunger for its warm, life-giving rays.

November 26.—At last we have had a little direct sunshine, and what seems very strange is that this has come to us with continued northerly winds. Without exception thus far, the wind from this direction has been warm and humid, bringing clouds, snow, rain and everything to make life uncomfortable. We can only come to one conclusion, which is that we have been steadily driven south against the main body of a closer pack. The pack before us towards the open sea, of which there is perhaps not less than three hundred miles, has been driven together. With such a condition of things we might suppose that the wind would not be so thoroughly



On January 1st, 1899, the *Belgica* was still Hopelessly Held in a Field of Ice Two Miles in Diameter, while within Two Thousand Feet there was a Long Open Expanse of Navigable Water.

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charged with pack vapour. But this is a hypothesis. The fact is that we have fair weather, which is unusual with wind from any direction but south, and we are feasting our souls on direct sunny rays, the first in weeks.

There is a somewhat surprising movement in the individual masses of the pack, as is seen by the changing position of the various icebergs. In this movement there is regular order in the direction. It is not a motion like the entire drift of the main pack, to and fro in response to the wind. The *Belgica*, firmly held in the body of a floe whose general diameter has been about four miles, has turned her prow steadily with but very little interruption from south in May, to west in August, to north in October, and she is now -22° C. on her way to the east. From this we can draw only one conclusion—that there is a feeble undercurrent which, acting on the bergs, is the cause of local disturbance in every pack. Our observations thus far verify this curious suggestion. The floe in which we are fixed has no icebergs in its grasp, like many of the floes around us. If such a current existed it would not be propelled with the same force as the berg-charged floes, but with a tendency to lag behind an active mass to the one side would, by friction against its side, cause it to revolve. Such has been our experience. A group of floes, in which there have been several huge tabular bergs entangled, has slowly but persistently passed around our starboard, while we have turned in response to it; and as a final proof of this movement we have constantly observed the appearance

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of new bergs south, and the disappearance of old friends to the north.

The winter effects on the ship have been extremely injurious. Her hull has been subjected to very little pressure, but she has been unevenly covered with snow; the stern, buried and forced below her natural water-line, has made her leak; the bow has been exposed to the many alternate freezings and thawings; the rigging, for much of the time, has been loaded with a ponderous weight of accumulated hoar-frost which, with its continued movement in the never-ceasing storms, has weakened every fibre of rope, and now the burning sun splits the masts like sticks of green wood near a fire. The interior has also suffered great injury. The constant drying effects of the internal heat has split or cracked nearly every important beam, while the seams are everywhere wide open. There are two things we seldom have here which will certainly seem strange to my readers. They are sunshine and snow-showers. In a region where the sun does not set for a period of more than two months, one certainly has a right to expect fair and sunny days, and likewise in an area where the whole face of the earth, both land and water, is buried under a perennial sheet of snow one naturally expects to see frequent falls of heavy snow; but in reality, both sunshine and actual snow-showers are very rare, so much so that their appearance affords a special delight and a great surprise. To-day we have had the phenomenal pleasure of having both in one day. Real sunbeams in the morning, large and slowly falling



Old Hummocks.



A Tonite Explosion Used in Efforts to Free the *Belgica*.

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flakes of snow in the afternoon. We have had appropriate music to celebrate the occasion and are happy.

November 27.—Our winter temperature was very slow in falling, and the minimum was not reached until after sunrise. Our lowest observation was recorded on September 8, -43.1°C . In less than ten days after this it had risen to a fraction above zero, and we were drenched with rain and melting snow; since then it has occasionally fallen to -20° , but it has slowly and persistently risen until now the normal temperature is one or two degrees below zero, falling with a southerly wind to -10° and rising above zero with a strong northerly wind.

The zoölogist has seen what he persists in calling a new bird. It resembles the giant petrel in size and colour, but its motion is entirely different. Anatomical details have not been observed, and, "The bird," says the naturalist, "is either shot-proof or it is able to dodge the lead." But since Mr. Racovitza had considerable fun from our mistaken reports of true sea-leopards, we have taken advantage of this story to restore our fallen reputation. We persist in saying that unless he produces the bird, or gives us an exact technical description, anatomical and physiological, we maintain the privilege of ascribing the sight to a kind of sunny intoxication which at present, under the influence of the midnight sun, is not uncommon.

CHAPTER XXVIII

SUMMER (CONTINUED).

DECEMBER 2.—Our drift lately has been almost imperceptible. The winds, always feeble and never continuing long in one direction, have simply kept up a little agitation in the pack while the tides have driven the bergs to and fro a little, and thus the pack has become more and more divided. For most of the time the wind has followed the sun around the horizon, and nothing could be more ineffectual in making ice navigable than light, shifting winds. Since it takes the pack a long time to gain momentum, a wind which does not last for several days is of no use unless it is a tempest. Our latitude to-day is $70^{\circ} 18'$, longitude $83^{\circ} 25'$. Our drift throughout the season has been considerable. If it had been in one direction it could have taken us across the south pole or to the magnetic pole.

During the winter, and a part of the advancing summer, we have made various guesses as to when the bark would be liberated from the grasp of the pack. The captain has set the day of departure at October 25; I at November 15; Amundsen, February 1. Both the captain and I are already overruled, and

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there is even some fear of a possible second winter. Yesterday a lead made its appearance 100 metres to the east, running north, and for the past few weeks we have watched with considerable interest the slow but persistent diminution of our pan. From its original nearly circular form, five miles across and three metres thick, it has dwindled to less than one-half its original size, and even the thickness of the ice is rapidly decreasing. The temperature has gradually ascended, with very many irregular curves, from an average in September of -18° to -3° C. now. But the change has been so irregular that the effect has hardly been felt.

During the entire winter and throughout the year, though snow fell almost every day, even on the brightest and the clearest days, the total snow-fall seemed small at all times. There are two reasons for this. First, the actual snow-showers, as seen in temperate regions, periods when much snow falls within a short time, were quite unknown. Second, the topography of the pack is such that every wind carries before it huge drifts of snow which it deposits in open leads, where it is either melted or converted into ice at once. During the blackness of the night, and during the endless gray snow-days since, we have constantly longed for a fair old-time snow-storm: a storm bringing sufficient snow to blanket the ship and keep us warm inside: a gentle, quiet fall of large, soft flakes to soften the hard outlines of the pack, and without the ever accompanying thunder of winds and whizzing, cutting, maddening ice-crystals. But

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such a pleasure has not been mixed with our assigned experiences. I think it is Nansen who says "the snowless ice-plain is like a life without love," and in this there is a truth which can only be realised by men who, like us, are imprisoned in the polar pack. The constant war of the winds, which here strive for a place, brings about a restless agitation of the ice. Now it is driven east, then north, then south, and so on, tearing the floes, crushing pans, crowding huge pieces over each other, making hummocks, cliffs, ridges, crevasses, and what not; a veritable chaos of icy destruction, a surface impassable for a journey, and unpleasant to the eye.

The sharp, rough angles of the hard ice project like the ribs of a famished animal, making a picture quite as melancholy in the feeble light of winter and early summer. Snow, deep, soft snow, has upon this coarse framework an effect like that of fat on the animal. It covers the ugly open rifts, pads the sharp corners, and it gives a smooth, pleasant, rounded surface to the pack in general. It buries the unpleasant ruggedness and the gloomy blackness under a velvety covering of white, which is always pleasing to the eye. It gives to the pack a face at once suggestive of warmth and fertility. It is only within the past few days that we have had sufficient snow at one time to give to our moving sea of ice this much-to-be-desired aspect. Snow has fallen in great quantities; not softly and without wind, but noisily and with the never-ceasing gale which is so characteristic of this region. The quantities, however, have been sufficient to bury the *Belgica* in a huge

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drift, and the bare ridges, hummocks and irregularities, are softened by the most beautiful crystal drift in which the sunbeams play like kittens.

December 16.—There appears to be a promise in the air and in the quick rising of the barometer which bespeaks a tempest, and how we long for it! Almost the entire year has been one long monotonous series of tempests, but now that we need one to break asunder the floe which retains us as prisoners, and open navigable leads of water, it is tardy in making its appearance. For nearly two months the barometer has been steady, and only spasmodic jerks or varying breezes have driven us about. If we had had but one of the many tempests which, during the winter, made life so miserable, we might have been freed. The temperature is rapidly rising; now generally about -2° C., at mid-day slightly above zero, and at midnight from -6° C. to -10° C. We thus have our greatest diurnal range. The snow on the pack is melting with a surprising rapidity, and about the ship there is a zone of water in which she sits in her natural environment. The pack everywhere is breaking into small pans, but our old floe holds together with a surprising tenacity; it is about seven miles in circumference, and is lessening very slowly along its fringe, but apparently the snow which the masts have swept and condensed out of the winds holds it with unnatural firmness, for it is certainly the largest floe in our neighbourhood. We watch every new piece which is torn off its edge with a pleasure and an assumed confidence of an early liberation, but if the *Belgica* were now in free water she could do

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nothing but wait. The ice is so closely packed that progress would be absolutely impossible.

These unsystematic winds and steady weather have kept us in a locality over which we have sounded and fished, hence there is a sort of stagnation of work—no sounding and no fishing. To obtain birds for the collection, meat for our food, and blubber to melt snow is, however, a matter of no little labour. The men have had the second week of half-days to mend their personal effects, and since these are next to nothing they use the time in hunting, reading and discussion. A new system of penguin hunting has been discovered. At meal-time a cornet is used to call the men together, and the penguins, it seems, also like this music; for when they hear it they make directly for the ship, and remain as long as the music lasts, but leave at once when it ceases. In this manner we have only to wait and seize our visitors to obtain penguin steaks, which are, just at present, the prize of the *menu*. But not so with the seals,—they like music, and will come up out of the water onto the ice to enjoy it, but they will not deposit their carcasses, penguin fashion, on board. On the other hand, when we approach them they are more easily obtained. A shot from a revolver straightens them out, but then, we have to transport 150 pounds of blubber and 50 pounds of meat over rough, hummocky ice to the ship. This is an occupation which easily drives sport out of one. Our good sailors, however, do it voluntarily, and at times when free from regular work.

A few days ago Amundsen and I resolved to make

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a final attempt to reach the tabular iceberg in the east. It has long been our ambition to do this, as it has been the one venturesome aim of every man on board. We have tried it several times before, but always in vain. Wide open leads have prevented our going more than four or five miles, and have also cut off our retreat. But now we decided to take no food and no provision for sleep, but to push boldly to the berg and back in one day. We left after *matte* at 4 o'clock; the wind was light and easterly, the sky clear, with a temperature -7° . We had no difficulty in making the first seven miles, but the two miles about the berg were much torn and separated by lakes. Among this small ice there were several seals, mostly Weddells (*Leptonychotes Weddelli*), but we also killed the first true sea-leopard (*Ogmorhynchus Leptonyx*) here, and also a crab-eater (*Lobodon Carcinophaga*), which we cached with a view to later use as a food supply as a last resort in case the ice separated so much as to prevent our easy retreat. We saw here, also, some giant petrels (*Ossifraga gigantea*), and some white petrels (*Pagodroma nivea*). The floes appeared smaller and smaller, as we approached the berg, and around it they were mere discs of about an average diameter of seven metres; these were separated by huge quantities of brash. After considerable difficulty we finally found a place on the iceberg where we could make a debarkment. The ascent was over a long platform which resembled an ice-fort of the arctic land-ice. It was the base of a cliff of ice which once covered it, but the

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berg was perfectly tabular. We estimated the iceberg to be 800 metres long, 500 metres wide, and 40 metres high. To its crest there was but one access in the valley made by the decay of a part of the cliff. We ascended this without difficulty, and reached the top in a few moments.

From here the view of the pack was superb. We counted seventy-five icebergs on the horizon, of which ten were tabular. They seemed to be evenly scattered over the pack. The sea-ice appeared blue under the midnight sun, for it was nearly midnight before we reached our destination. The floes seemed small, averaging about one mile in diameter, except those close to the berg. Here and there were seals, and white petrels flew about our heads. The *Belgica* appeared in the endless blue expanse westward, and to us, at our distance, she was not unlike a stick in the ice not far off. Nothing particularly new was in our increased horizon; possibly a few new bergs were in view eastward, but about these there was little remarkable. From the crow's nest on the ship, we could count sixty-four icebergs, and the view in general was similar to that which now spread out before us. The top of the berg had a gentle inclination westward; its surface was generally flat, excepting here and there the line of a crevasse filled by re-congelation. We came back over the same path on *ski*, which we had used on the top, and for the first two miles we had no serious trouble. The ice had remained the same, but at this point there had been much commotion. The easterly wind had gone down, and the ice im-



Removing the Upper Sheet Preparatory to Sawing the
Hard Undersheets.



Cutting a Canal through the Ice to Release the *Belgica*
from her Year's Imprisonment.

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mediately began to separate, and thus in the few hours occupied by our ascent onto the iceberg the entire topography of this part of the pack had changed. Huge lakes had formed, and a dense fog shut off our way. With the compass we sought points of each floe where they touched others, and thus we worked until 4 A.M., when we reached the ship with photos of the berg, and the head of the leopard as a trophy. The work and the resulting fatigue had been so great that Tollefsen, who had joined us at the last moment of our departure, fainted twice after he reached the ship. Poor fellow! his brain has for a long time been unsteady as a result of the unbroken daylight and hopeless isolation. We thought this jaunt would do him good, but it has had a contrary effect, for his mind is now permanently deranged.

December 25.—Christmas in midsummer is certainly an anomaly to residents of the northern hemisphere, but our midsummer is more sterile than the midwinter of any known spot on the globe. At home there may be snow and wind, but there is at hand the companionship of warm friends, the cheer of a bright fire, the charm of flowers and pretty things; but what have we in place of this accustomed holiday gayety? Each man has, among the *Belgica's* company, his special corps of chums, and brotherly distress has strengthened these bonds, but there are no other human souls within reach to enter our narrow circle of life with new inspirations. We have long since worn out all social enthusiasm, and can unearth nothing new to infuse fresh life into the

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desired good cheer of our Christmas dinner. Inside then, there is nothing new, while outside all is cold and white and wearisome. There is no flowering-plant within thousands of miles, and no land, not even barren rocks, within hundreds of miles. At dinner we drank to the health of "King Leopold," to the pleasure of "Queen Wilhelmina," to the continued success of the expedition, and everybody expressed a hope of an early release from our ice-imprisonment. Altogether, I noticed that the enthusiasm was forced. At heart we were not in a feasting mood, and the doubt of our future was pictured on every face.

We have now been nearly a year in this hopeless desert of ice. Everything seems solid and immovable. We seem to be frozen to the earth, for there is nothing which indicates movement. But with all this appearance of solidity we are in reality continually afloat, adrift with the polar winds, on a perennial ice-sheeted sea. How we long to put our feet on solid ground! We do not desire so greatly to see trees, and plants, and flowers as we do to sit upon something immovable; something not covered with this eternal whiteness, and not glittering with a dazzling iceblink — plain ground and bare rocks will satisfy us.

January 1.—New Year's Day passed like Christmas, with a special feast followed by anxious discussions as to the time of our prospective liberation. We are now doing much travelling over the pack-ice, studying the life and the ice-changes. The *Belgica* is about ready for the sea, so far as her internal



Floating-Mountains of Ice.



View from the Top of a Tabular Iceberg.

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arrangement is concerned, but outside there is nothing which promises a disruption of the ice in such a manner as to permit us to push out of it. The field, in which the bark is held, is still about two miles in diameter. The sun has reached its highest altitude and is sliding down the hillside of winter. We cannot hope that the fading days of summer will bring us relief, since the bright days of November and December were of so little avail in breaking the ice.

In October and November the ice separated, leaving wide open leads, often a mile in width, winding around the floes to the end of vision. If we had been free at this time, we might have gone farther south or north to the open sea in a short time, for we were then only about two thousand feet from a lead of navigable water. We are not now any closer, but the entire pack has changed since then. Around the bergs the ice is broken into small pans. There are a few fields about two miles in diameter, but the main body of the pack is made up of floes less than a half mile in diameter and with an average thickness of six feet. This smallness of the floes prevents severe pressure, but it gives the pack a sort of elasticity which opposes the formation of wide open leads necessary for navigation. We no longer see the great zones of tempting sea, but instead, only small lanes along the edge of the large fields. If, however, we were able to get into these we might take advantage with every shift of the ice to force our way into more favourable localities.

Since Christmas the weather has already become colder. New ice is forming every night, but early

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in the morning this thaws again and the snow of the pack is melting rapidly; the solid ice seems to lose little of its thickness, though it is becoming more porous and is more easily disrupted. By a series of holes drilled by Mr. Arctowski, he finds the general thickness to be 2.60 metres. This is nearly the same as I found it to be two months ago; from twenty-five measurements along fresh cracks it was 2.65. To-day there are many signs of pack movement, but for three weeks with the steady easterly winds we have moved south-westerly, holding the same relative position with our neighbouring icebergs. A sudden brisk westerly wind is sending us east and north rapidly. This wind does a triple service. It sends us north, it loosens the pack, and it breaks the floes. It is indeed a godsend so early in the new year, for we are already half expecting a prolonged ice-imprisonment through another year, and if for another year, perhaps for much longer.

At midnight we, of the cabin, went forward to surprise the crew. We took with us a liberal allowance of wine, also an abundance of cheese, ham, and biscuits for a lunch. The sailors received us with song and music, and then told us stories which were new to us, but had been told a hundred times in the fore-castle. We in return did some speech-making, and a little story-telling, too. The meeting was certainly a success as an entertainment, and though the music was limited to accordions which, from the combined effects of cold, humidity, and rough usage, had many defects, we sat and listened to the discordant notes with real enjoyment.

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Outside the scene was beautiful, the sun was in the south, low on the horizon, spreading golden rays over thin stratus clouds to the zenith. In the north the moon was high, and though somewhat paled by the sun it was bright, and stood out in the cold, cloudless blue like a ball of lustreless silver. The endless sea of ice under us was ridged by a line of pressure, at right angles to the line of force, which was from south-west to north-east, and separated by inky lanes of water parallel to the lines. The entire ice was a mass of quivering blue. It was thus midnight and midsummer, and New Year's Day, and to this series of strange contradictions we owe the peculiar phenomenon of seeing both the sun and the moon at the same time, and that at a nocturnal scene.



CHAPTER XXIX

FREED FROM THE ICE-EMBRACES— RETURN TO CIVILISATION

JANUARY 5.—We are satisfied with the success of our mission to the present. We should like to terminate our campaign with a striking sweep of discoveries, such as marked our beginning last year, but such a hope is now quite beyond the range of possibility. Our provisions are nearly all used, and to penetrate again into another part of this ice-strewn sea, with our present equipment, would be injudicious. We are inclined to bundle our results, and quit the under-world of ice as soon as the ice breaks enough to give us freedom.

Indeed, we ought to be contented with the unparalleled series of scientific records which are now written in our journals. Beginning with Tierra del Fuego, we have secured ethnological data of a race of primitive people, scientifically unknown; there we have also read the story of two vanishing American races; while the naturalist and geologist have worked out facts and gathered specimens unique in value and usefulness. We have sounded the unknown seas between the terminating point of South



Curious Weather-worn Icebergs, 300 Feet High.

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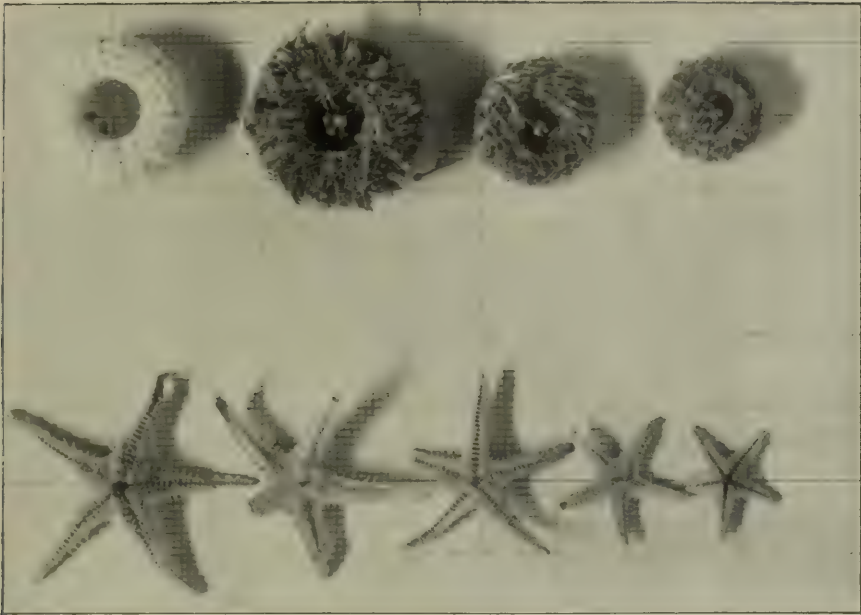
America and the antarctic land. In the new regions south of Cape Horn we have discovered many islands, and several hundred miles of the coast of a great country. Passing into the pack-ice we have drifted thousands of miles over the bed of a virgin sea; have discovered a great submarine bank, and have collected skeletons and skins of a curious life, previously almost unknown. Racovitza has hundreds of bottles of odd-looking specimens of creatures in alcohol, and his notes record, for the first time, the life story of antarctic fauna throughout the year. Arctowski has a record of hourly meteorological observations taken systematically, night and day, during one year. This, too, is a valuable record, for previously we have had only a few short notes on the climate of the summer months of the antarctic. Lecointe has made a painstaking series of magnetic observations, which will be useful in making valuable deductions for the compass, in the southern hemisphere. There are many studies valuable to oceanographic sciences, and our examination of a part of the great restless sea of ice, which encircles the pole, will be the basis of all future work in this region. We shall emerge from an area of perennial winter, never before invaded by man, with the knowledge of having been the first of all human beings to pass through the south polar winter and its long night. We feel, one and all, that our mission has been accomplished, and we are waiting impatiently to be freed from this embrace of the frozen sea.

January 9.—From the first to the ninth there was

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little of interest aside from the usual run of life. We took a few Ross seals (*Ommatophoca Rossi*), saw two new birds, but did not secure them, and were generally busy preparing the ship for the home voyage. We have had a continuous southerly wind, but its force was so light that we drifted little, though our sounding yesterday was 1490 m., which we take as an encouragement of a northerly movement off of the shallow sea over which we have floated so long. The bergs continue to change positions, but our pan, which is a little over two miles in diameter, is the same as it was two months ago, except that the snow has melted to an average thickness of about a half metre. Because our floe has not changed its form or shown any signs of disruption since November first, and also because we have had no ice-destroying tempest since that time, we have no good reason to suppose that we shall have a storm, or that our floe will fracture in a line to liberate us during the remaining two months of possible navigation.

There is at present sufficient water in long leads to navigate, and to reach this is the ambition of all on board, from the Commandant to the cabin-boy. But thus far we have done nothing to liberate the ship. It is true, our men have had more than sufficient work to prepare the sleeping *Belgica* for the sea, but for this they will have sufficient time during the many days when we shall be pressing out of the pack. If we do not help ourselves, as matters go now there is a great possibility of wintering again in the pack. To do something in this direction, I submitted, yesterday, a plan to the Commandant.



Star-Fish and Sea-Urchins from the Bottom of the
Antarctic Sea.



A New Shrimp of the Genera of Euphausia, Discovered
by Racovitza. It is the Staple Food of the
Penguins and Seals.

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It is based on the fact that the sun acts much more powerfully upon water, and upon everything else of a dark colour, than upon snow. Keeping this in mind, my suggestion involves the digging of two trenches, one from the bow, the other from the stern to the water, at the edge of the *Belgica* field. These trenches are to be carried through the snow and the superficial fresh water sheet of ice, leaving a narrow current of water from the ship to the lead, which we hope by the aid of the sun will so weaken the ice in this direction that it may break in this line. Otherwise it might fracture, if it fractured at all, a mile to the other side of us, and then our position would be no better than it is now.

January 12.—We have finished the trenches. For three days we have worked, not like men, but like dogs in chase of game. With picks and axes and shovels, we have excavated the ditches, and have hardly taken time to eat or sleep, because we have been so eager to watch the progress and effect of our work. As the work is completed, we find that our project is a failure. The sun at midnight is now so feeble that it permits the formation of new ice to such a thickness that the heat of the following day is barely sufficient to melt it. Had we done this in December, the result might have been more satisfactory, but now it is too late.

With the cutting of these trenches I proposed, as a last resort, to cut a canal through the ice from the *Belgica* to the edge of the field. The lines for the trenches were so laid that the saws might be run through the same groove; in this way we hoped

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to save the labour of twice removing the upper sheets of ice and snow. The work of sawing was begun last night and at first the progress was encouraging. Upon more careful examination, however, by drilling, we found that the lines which we had laid out for the canal, though shorter, ran over several submarine projections of ice from fifteen to twenty-five feet thick. We had learned by this time that with the saws it is nearly impossible to cut ice more than seven feet in depth. We now began renewed experiments with tonite, an explosive said to be more powerful than dynamite and much safer. It certainly is decidedly safer, but we were unable to discover its power.

Two months ago we all had faith in tonite. We had on board a large supply, and believed that with it we could blow the *Belgica's* ice-fetters to atoms. Our confidence was much shaken with the early experiments. In the first trial we were afraid of the stuff. We handled it with the greatest care, placed it cautiously on a sledge, and drew it with a long rope. We selected a spot nearly two miles from the *Belgica* for the first explosion. At the time of this experiment the bark was not yet ready for the sea, and we thought it not wise to break the ice in close proximity. We also feared the "great power" of the tonite, and thought the whole field would be broken and scattered in the air, only to fall down and smash the decks, but all of this faith in, and fear of tonite changed upon a more intimate acquaintance with the stuff. We are now amused at our extraordinary precautions during the first experi-

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ments. We took the tonite far away, put to it long fuses to permit us to run off a great distance out of the reach of the expected shattered fragments. The explosion went off with a hiss and a great fire, but in the air there was only smoke, and under the explosion there was only soot and a concavity in the snow. There was nothing broken, not even a hole through the ice, and we stood a half mile away behind a hummock, shivering for fear the ice would be so broken that we could not return to the *Belgica*. In later experiments we were more bold, and brought the scene of action nearer the ship, but we found that in temperatures lower than -10° C. (14.0° F.) the tonite exploded feebly, so much so, indeed, that the engineer, seeing the beautiful fire it made, vowed he would get better service by using it to get up steam. Most of us have lost faith in the power of tonite to release the *Belgica*, and we have also lost faith in its power to do damage of any kind. Instead of handling it with the extreme care of a few months ago, we now have it in our beds, on the table, and in every corner of the cabin. Lecointe and Racovitza, however, still have some confidence in the destructive powers of the explosive, and before we begin the seemingly impossible task of sawing a canal it is important to determine the limits of tonite in breaking the ice.

A number of experiments were made yesterday and to-day, but the consensus of opinion is that tonite will "cut no ice." If we are to get freedom, we must seek it by our own muscular efforts with the saw and the axe. We have argued for several

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days in favour of sawing a canal. To this there has been considerable opposition, based upon the fact that the entire working force could not be spared for such work, and that the suggestion, at best, gave little promise of success. The sawing experiments in the trenches, however, proved that much could be done, and the eagerness of the men assured a concerted effort if the plan could be made the one aim of everybody. The repeated failure of the tonite proved that a continuation of our work in the old trenches was unwise, because ice of more than seven feet was impregnable to us. Gerlache has suggested the sawing of an old lead over the stern which might prove less obstructed by hummocks. A vigilant sounding of this lead proved the general depth of the ice about five feet, but the distance was somewhat greater than the line of our trenches. A careful study of all other possible routes easily proved this the most practical. The plans were then made as cautiously as if we were to dig the Nicaragua Canal, and every contingency was vigorously discussed by the officers. When the project was once thoroughly developed we divided into three or four crews according to the work, and every man, from the highest officer to the cabin-boy, took to the saws and the axes.

The work on this canal was begun on the evening of January eleventh, and was continued night and day until the bark was released. The distance of the canal was about 2200 feet. The sawing of the two sides with the cross sections made the distance to be cut, in a straight line, something over a mile

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and a half. We were able to remove the upper sheets of ice and snow by shovels and picks and specially constructed implements to the depth of from one to two feet. This left solid ice from three to four feet thick to be cut by the saws. We kept at it day after day, working eight hours daily, as do day labourers. No men ever worked harder or more faithfully. We were sixteen in number, officers and sailors working side by side, with no easy berth for anybody. Our main food supply was only sufficient to last three months longer. We were accordingly put on reduced rations, but we had a plentiful supply of seal and penguin meat and were adding to the larder every day the game coming into our new canal. We ate ravenously, and were contented with the fishy penguin steaks, developing strength and enthusiasm with the increased length of the canal.

January 23.—We are still hard at work at the channel for the release of the *Belgica*. Every man is still putting in eight hours daily on the work except the cook, and he is working twenty hours a day in doing his own work and that of the cabin-boy and steward. The work is proceeding nobly, so quickly and so perfectly as to surpass all expectation. This can only be explained by the cheerful manner and manly vigour with which every man is at work. The men need no urging, no special direction, no superintendence. Given a plan and system of action, they arrange themselves and work with an effort almost superhuman. The Commandant, the captain, the first officer, the meteorologist, zoölogist, and the doc-

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tor are all shoulder to shoulder with the sailors, and occupied at the same work. The meteorologist says, "There simply exists no longer a Commandant, no captain, no officers. We are all ordinary workmen."

I have had little time to write for one week. Eight hours daily with a heavy saw, and the spine twisted semi-circularly, is not conducive to literary ambitions. It is, however, a capital exercise. Everybody is being hardened to the work and developing ponderous muscles. Our skin is burnt until it has the appearance of the inner surface of boot leather. Our hands, we have found by experience, are more comfortable if not washed, especially with soap, because then they crack and become painful. The result is that we all have a more savage physical appearance than most Indians. But this is of little consequence to us. There are no ladies here to arouse the sleeping vanity which we all once possessed, and our one ambition is to free the ship. This now seems quite certain. We eat like bears the meat of seals and penguins twice daily, disposing of three, four, and five steaks each. We find time and gastric capacity for no less than seven meals daily. All work was stopped Sunday morning at 4 A.M., and it began again Monday, at 8 A.M.; during that time we slept no less than thirty-six hours, and twelve hours is about an average of our daily sleep with the channel work. Before the canal was begun we could barely sleep eight hours.

By the first of February we had extended our canal to within one hundred feet of the *Belgica*, but the ice which remained to be cut was from six to

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seven feet in depth, and of a consistency so hard that the saws barely made an impression upon it. In one spot we sawed eight hours and cut less than five feet. While we were busily occupied in devising new plans to cut this ice, the wind changed and altered the drift of the ice, bringing a strong pressure on a tongue of the floe, which caused a fracture contiguous to our canal, around the bark and through the remaining ice to the edge. This new crevasse opened, and in so doing, the new floe drifted, partly closing our canal. This sudden and unexpected change, before our canal was completed, brought a look of disappointment and despair to every face. Now our prospective way of retreat was not only useless, but our position was such that the *Belgica* was subjected to dangerous pressure. To relieve this pressure we cut an oblong concavity in the body of the main floe with the idea of taking the vessel to this as a harbour. In this effort we succeeded on the evening of the thirteenth, but our canal was so effectually closed by new ice and the pressure of neighbouring floes, that we could not escape. On the morning of the fourteenth, the wind again changed. There was a general expansion of the pack, leaving wide open leads on all sides, and our canal again widened. We lost no time in steaming out. No body of men were ever happier than the officers and crew of the *Belgica* as the good old ship thumped the edge of the ice which had held her a prisoner for nearly a year.

Our supply of provisions did not permit a continuation of the campaign, and after all our mission was

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about fulfilled. Accordingly we headed northward in the most direct manner for the open sea. In two days we pushed, through closely packed ice, twenty miles northward, and then we entered a zone of the pack where the ice was broken into small pieces and closely pressed by an almost continuous line of icebergs. Beyond the bergs there was a dark blue-black sky which, after a time, we recognised as a water sky, indicating that under it there was the open ice-free Pacific. Here, within sight of the open sea, we were again imprisoned by the closely packed ice for thirty days, but at last, when we had almost abandoned all hope of escape and were preparing for work during a second winter night, a gentle southerly wind drove us with the sea ice out beyond the line of icebergs, and then we were free to seek the world of life in our own way. We left the pack-ice in latitude $70^{\circ} 45'$ south, longitude 103° west, and then headed for Cape Horn.

At last we feel again the pleasure of being out of the frigid stillness and on the bound of the broad ice-free waters. We have left the white line of the pack-ice under the black sea behind us, and now the ever-present electric glimmer, the iceblink, is fading over our stern. As the blink vanishes, and the sky is screened by the normal South Pacific dulness, we descend from our world of lofty thoughts, in which we had been raised and upheld by the long months of isolation, and frost, and storm; and with this descent our minds and our hearts are set on the joys of home-going. The feeling of isolation and desertion now comes over us stronger than ever be-



A Group of Penguins,—Visitors to the *Belgica*.
To the Left is a Lead into which They dive for Food.)

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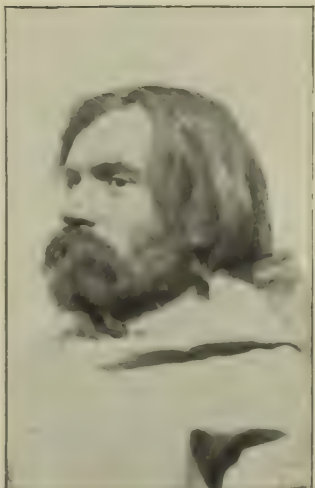
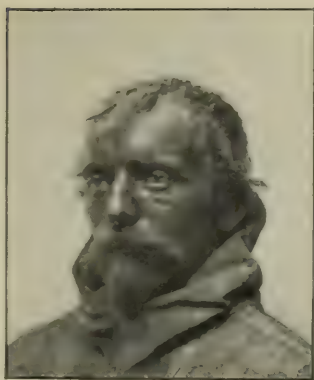
fore. There is still a long spread of tempestuous waters between us and Punta Arenas, the nearest outpost of civilisation, and as we plough this hopeless sea, with souls raised to a fever-heat of anticipation, our old winged companions in the long drift with the frozen sea leave us. While among them, we thought we were wearied of their songless poses on the icy spires, and of their noiseless flights. We believed that we had seen all of their cold white world that we ever desired, but even before we have felt the heat of the sunny inner zones we are half sorry to leave this weird other-world life. A year hence, I am sure we shall all long to return again to this death-like sleep of the snowy southern wilderness; but just at present we long, as no tongue can tell, for the kindly breast of Mother Earth, with her soul-stirring warmth, her running streams, her sweet-smelling flowers, and her air of colour, of perfume, and of pleasant musical sounds.

On the morning of March 28, 1899, we steamed into the port of Punta Arenas. After a fifteen months' absence from civilisation the new delights which we saw around this end-of-the-world town were surprising. We noticed with considerable interest the worn roads snaking through grassy fields, around groups of trees to the summits of green hills. Behind us were the olive and purple waters of Magellan Strait. The harsh Cape Horn winds, which blew over the forest-covered lands, seemed soft to us; to our frozen perceptions the sweets which these winds brought seemed to combine into one joyous perfume.

Little time was lost in seeking the shore. We

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were hungry for home news, and anxious to tread on solid ground. The sensation of having real earth under our feet was new to us. For more than a year we had roamed about over the moving frozen waters of the antarctic sea, with no sight of land, and no feeling of stability. When we mount the first hill we shall sit down and watch and wait to see if it, too, does not move like the hills of ice upon which we have rested so long. We landed quietly, and almost unnoticed; there was no crowd, no tooting of whistles, and no display of bunting as we passed over the long iron pier. In Patagonia nothing short of a volcanic eruption creates an uproar, which was to our liking, for we hated excitement and display and much desired to spend our time as it best suited our inclinations. A few of the sailors who came ashore remained on the beach, kicked about in the sand, and tossed pebbles. So much were they interested in this first touch of solid ground that they continued to play in the sand for hours, with the delight of children at the seashore. The officers marched straightway to a hotel, but in getting there they were made to feel their own previously unnoticed awkwardness. It is a sad undertaking for one endowed with a graceful walk to engage in polar exploration. I do not know whether any one on the *Belgica* ever boasted of such an accomplishment, but I do know that our walking attitudes, as we strolled up these streets, were a study in alcoholism. We had travelled on *skis* and other snowshoes so long, and had been tossed about on the sea so much, that we had forgotten how to walk normally.



The Sailors at the End of the Long Night.

M. Van Rysselberghe.
J. Koren.
H. Johansen.

A. Tollefsen.
J. Melierts.
H. Somers.
E. Knudsen.

J. Van Mirlo.
G. Dufour.
L. Michotte.

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We spread our legs, dragged our feet, braced and balanced our bodies with every step, and altogether our gait was ridiculous. It may all be imagination, but we felt unnatural, as, indeed, we must have looked.

We had hardly learned to realise this ourselves when we got a glimpse, for the first time in many long months, of a woman. She simply stood and stared at us, and we at her, and then she gathered up a couple of youngsters nearby and rushed away from us into the house, as if we were dangerous characters. Morally hurt by this incident we went along taking some notice of the men who eyed us with considerable interest. Presently we passed a door in which two pretty girls were standing. This sight sent a new sensation through us like that of a Faradic battery. Somehow we all, at the same time, unconsciously brushed aside the year's growth of hair from our faces, and made an effort to arrange our neckties and change the set of our coats, but we were made to realise, more and more, that we looked hideous. The girls gave a sudden giggle, rushed back into the hall, and we had to content ourselves with the rustle of skirts. This rustle of the skirts of these first girls who warmed our frozen hearts would make spicy poetry if we dared to write it. But we are not poets: we must hasten on to the hotel where we hope quickly to change our freak-like appearances.

At the hotel we soon learned something of the events which had occurred during our absence, but we were able to get very little connected news. The

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Spanish-American War and the Dreyfus Case, of which we knew nothing, were explained to us. We next tried to get a hasty glimpse of the newspapers, but the fifteen months previous being a blank to us, we were unable to read the papers with any idea of assimilation. It was impossible for us to understand the short daily announcements until we were able to get a general idea of the drift of the previous events, and this we knew would take long. We next returned to our rooms and began to scrutinise ourselves in the mirrors, to learn the reason why mothers guarded their youngsters, and girls ran away as we came along the streets.

We presented curious and funny physiognomies. Our faces were drawn, and but a shade lighter than old copper kettles; our skins were rough, like nutmeg-graters; and our hair was long, stubborn, and liberally lined by bunches of gray, though the eldest among us was less than thirty-five years of age. Our clothing was in a good state of repair, but its appearance was odd. We had been short of patching material, hence pieces of leather, bits of canvas, and strips of carpet were used to cover the tears and to reinforce the weak parts of our coats and trousers. We were ourselves so used to all of this that we did not think it strange; but when we heard the rustle of skirts it brought our sleeping vanity all back. Henceforth we must again wear boiled shirts and bright feathers. We soon brought in the barber, who made for us new faces, and the tailor, who fitted us with presentable up-to-date outfits. While this was being done the mail was brought, and at once each took a bundle and wan-

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dered to some corner. These were moments of sentiment. Business letters, cheques, drafts, papers, and, indeed, the bulk of correspondence was put aside, and each had soon in hand a series of sheets with feminine inscriptions, in which all interest for the time was centred. Racovitza said: "What means it all? Surely the indications are that in six months there will be as many new wives as the present number of bachelors on the *Belgica*."

After a time, however, this sentimental trance gave way to material instincts. We had ordered a dinner to be specially prepared for us. We didn't care for fancy dishes and desserts; our appetites craved plain substantials. We had fed during a year on "embalmed" foods and meat, tasting like cod-liver oil. We enjoyed this when we could get nothing better, but now we want beefsteak, and a good deal of it. The waiter interrupted our interesting occupation by the announcement that dinner was ready. We all followed without a second bidding, and I should be ashamed to confess to the amount of beefsteak which we devoured.

In a few days we settled down in the normal routine of life. An opportunity was found to send a cable message by steamer to Montevideo announcing our discoveries and the general results of our explorations. Most of us lingered a few weeks in southern South America to prosecute various branches of research, and then the scientific staff sought their respective homes by the easiest and quickest routes, leaving the *Belgica* to follow in her own slow way.

It seldom falls to the lot of polar explorers to be

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made to feel, as we have been, the importance of their work and the success of their mission. By the honours bestowed upon us by his Majesty, King Leopold; by medals from the Royal Society of Belgium, the Geographical Society of Brussels, and the Municipality of Brussels, we are assured that our hard efforts have been appreciated. The favourable criticism of the geographers of all lands convince us of what we had hardly dared to hope, that the expedition was an entire success. I am sure that I voice the sentiment of every member of the expedition when I say that in receiving the substantial recognition of King Leopold, of the various scientific societies, and above all of our fellow-countrymen, we feel that we have been rewarded beyond our deserts. Such appreciation by knowing critics is indeed the highest honour which falls to man.

APPENDICES

APPENDIX No. I

GENERAL RESULTS OF THE BELGIAN ANTARCTIC EXPEDITION

BY

ÉMILE RACOVITZA

TRANSLATED BY PROFESSOR ÉMILE COULON DE JUMONVILLE

A GREAT many parts of our globe are yet unexplored or imperfectly known. Among these regions the antarctic is certainly the largest and the least known, but not the least important.

The solution of the numerous questions connected with atmospheric circulation and oceanic waters, the biology of aquatic animals and the geographical distribution of living species, depends upon the progress of our information in that part of the globe. The aim of antarctic expeditions must, for the present, be scientific. It is of far less importance to reach high latitudes in those quarters than to bring as much scientific information as possible. It was this idea which moved Adrien de Gerlache, the promoter, organiser, and chief of the Belgian Antarctic Expedition. He consecrated to the scientific implements an important portion of the feeble resources he had on hand, and surrounded himself with specialists to whom he intrusted the care of making scientific observations during the voyage.

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To Georges Lecointe was intrusted hydrography and cartography; to Émile Danco, the magnetic observations and the pendulum—after the latter's death, which occurred in June, 1898, his service was continued by Georges Lecointe. The meteorological observations were made by Henryk Arctowski and by Antoine Dobrowolski. Arctowski also had charge of the oceanographical and geological studies. Frederick A. Cook, the surgeon of the expedition, took charge of the photographic service and anthropological observations. I was charged with the zoological and botanical observations.

The materials brought by the expedition are numerous in all their branches, but their study will not be completed before two or three years. It will not be until then that we can ascertain the importance of the results obtained. Thanks to the Belgian Government, a great publication is expected, and a commission has been chosen to organise and direct it.

We can, nevertheless, and immediately, enumerate some of the results. This is what I propose to do in a few words with this reservation: that these indications are, for the most part, provisional and far from representing a complete table of the scientific advantages which will be derived from the expedition.

GEOGRAPHY AND GEOLOGY

THE geographical discoveries were made in the south and west of Bransfield Strait in Dirk-Gerritz Archipelago. In this region earlier explorers noticed a large land (Palmerland), separated by a gulf (Hughes Gulf) from another land situated in the east (Trinityland). Larsen, the captain of the *Jason* (1892), having seen south of Louis Philippeland a vast communication between the Atlantic and the Pacific,

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Trinityland became an island for geographers. Dallmann, the captain of the *Grönland* (1872), had discovered on the Pacific side an entrance to a strait (Bismarck Strait). Geographers then made an effort, upon the maps, to communicate Hughes Gulf with Bismarck Strait.

The observations of the Belgian Antarctic Expedition demonstrate that this is all incorrect. Palmerland is a vast archipelago of small islands; Hughes Gulf is the entrance to a large strait which brings Bransfield Strait into communication with the Pacific Ocean. This strait extends from latitude $63^{\circ} 51'$ to 65° south, and its direction is northeast to southwest. The Pacific mouth of Belgica Strait does not coincide with the entrance to Bismarck Strait, which, from the position assigned by Dallmann, is situated much farther south; but it is possible that Dallmann made a mistake in his observation, and that this is the very same strait. Trinityland is but the cape-land of a large tract (Dancoland) which forms the eastern shore of Belgica Strait, and which is only the continuation of Grahamland.

The shores of Belgica Channel are formed by high, mountainous table-lands with steep slopes and narrow valleys. One of the peaks appears to rise above an altitude of two thousand metres. The channels which separate these lands have steep perpendicular shores and possess great depths in their centre. The appearance of these lands and channels indicates that we have to do with a sunken region, in which the valleys were invaded by the sea. These lands are entirely formed by ancient crystalline rocks, granites, greenstones, and syenites. We have seen gneiss only at the mouth of the Pacific Strait. This fact indicates that we were in the central part of the antarctic chain, whose general direction is that of Belgica Strait. At the time of our sojourn in these regions, from the 23d of January

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to the 12th of February, the strait was free from ice. There were only a few icebergs. If some small islands were only partially covered with ice, all those of a larger extent and Dancoland were completely covered with an immense crust of ice which showed itself under three different forms. The interior was all occupied by a frozen sheet, which may be compared with the Greenland inland ice. Everywhere upon the mountain-sides were suspended glaciers, and in all the valleys were tremendous crystalline currents which ran into the sea. The limit of eternal snow coincides here almost to a certainty with the level of the sea. The study of the moraines allowed us to state that the glaciers had receded, and at the same time gave us a decisive information as to a much more considerable extension at an anterior epoch. The erratic materials furnish us with rocks much more varied than those found on the spot. We have even met with transformed sedimentary rocks.

Another important geographical discovery is that of a continental table-land or plateau situated between longitude 75° and 103° west of Greenwich, and from latitude 70° to $71^{\circ} 36'$ south. Its mean depth is 500 metres; with an abrupt fall to 1500 metres towards the north. The depth of the continental plateau, generally placed at from 200 to 300 metres, shows that this region has also undergone the depressive movement which was remarked in the lands of Belgica Strait. The continental plateau rises gently towards the south, and lowers in its eastern portion towards the north in order to connect itself most assuredly with the continental plateau of Graham and Alexander lands. It must connect in a like manner towards the west, fifty degrees farther, with the continental plateau discovered by Ross east of Victorialand. We would then have a continuous or uninterrupted continental mass from longitude 50° west to 63° east. However, the discovery made by the *Belgica* gives a

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serious support to the hypothesis of an antarctic continent —an hypothesis made the more likely from many other considerations, of which I shall cite only one, which is in its place here; that is to say, the terreous nature of the sediments of the continental plateau and neighbouring regions. Indeed, these sediments contain, besides the grayish slime, a very strong proportion of sand, gravel, and a very great number of pebbles of rounded form, which were certainly rolled by the sea, and were a part of a littoral cordon. I need not say that the transport of these substances must have been made by the ice. If this plateau indicates the existence of a continental mass south of the seventy-second parallel, inversely, the driftway of the *Belgica* demonstrates the non-existence of the ice-wall reported by Bellingshausen, and the same thing may be said of the land signalled by Walker, since we passed with the ice-drift over its supposed position. The easy drifting of the pack towards the west renders impossible the presence of the land reported by Cook towards longitude 105° west.

ASTRONOMY AND MAGNETISM

THE magnetic observations were the object of mensuration upon the deflection, inclination, and terrestrial magnetic intensity. They were effected principally with the aid of the Neumayer apparatus; Gambey's compass and Brunner's theodolite were utilised on land, either at the stopping-places on Belgica Channel or in the known regions, where they were used for comparing and determining constant quantities. On the ice-pack the perpetual motions of the ice did not allow us to install our apparatus for variations. Absolute and ready measurements were the only ones made. The magnetic stations number sixty.

The astronomical observations had for their principal

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object chronometric regulations. We utilised the method of lunar distances—that of star occultations by the moon, as well as the eclipses of Jupiter's satellites.

Pendulum measurements were made in the Strait of Magellan, at Punta Arenas.

The sketch of Belgica Strait was drawn by taking, as principal points, twelve stations whose co-ordinates were astronomically determined. The other stations were obtained either by the method of sufficient segments or by that of magnetic bearings. We employed also Admiral Mouchez's method.

While drifting, the positions of the ship were observed and calculated either by Marcy Saint-Hilaire's method or Borda's, when the latitude had been determined beforehand by a culmination or a circummeridian.

METEOROLOGY

THE only notions we had about the climate of the antarctic were based upon the very inadequate observations made during the three summer months. The Belgian Antarctic Expedition is the first which enables us to furnish a series of observations taken hourly during a full year. These observations were made during the year of the imprisonment of the *Belgica* in the ice-pack between latitudes 70° and $71^{\circ} 36'$ south, and from longitude 85° to 103° west. In order to appreciate thoroughly the conclusions which can be derived from these observations, we must not forget that the *Belgica*, during her wintering in the ice-pack, was in the neighbourhood of free waters; in consequence, the climate studied is a coast climate, influenced partly by the neighbourhood of the sea, partly by that of the continental antarctic land mass covered with eternal snow. The definite corrections of figures obtained

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have not as yet been made; still, we are able to present the general results with an adequate approximation.

The minimum temperature was observed in September; it was -43° . The maximum is remarkably low: $+2^{\circ}$ (in February). The month of July is the coldest of the year, with an average of -22.5° . The warmest month is February: average, -1° . The mean temperature of the year is -9.6° , an extraordinarily low figure for that latitude.

North of the Spitsbergen, at latitude 80° north, we have -8.9° . The mean temperature in summer is -1.5° , a figure just as remarkable for its latitude, considering that the expedition of the *Fram* obtained for a summer average -1.2° by latitude 84° north. This low temperature can only be explained by the absence of land towards the north, and the presence of an antarctic continent entirely covered with ice. This hypothesis is based upon a fact which was observed by the expedition. Every time the wind blew from the north the temperature rose, even in midwinter, to 0° , but did not ascend higher. As soon as the wind shifted and blew from the south the thermometer descended abruptly, even in the middle of summer, to a very low temperature.

In the interior of the antarctic continent there must be a pole whose temperature is much lower than the frigidity of the arctic poles of cold; the frozen surface of the antarctic continent is in effect much larger than that of Greenland, northern Siberia, or North America. The zone explored by the *Belgica* lies in a cyclonic region; yet the mean barometric pressure of the year, 744 mm. .7, obtained by a direct observation, is superior by 6 mm. to the theoretical figure obtained by Ferrel for that latitude, and demonstrates that the pressure does not decrease progressively towards the pole, where, on the contrary, there must reign an anticyclone. The absolute minimum was 711 mm. .74,

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one of the lowest pressures observed on the level of the sea. The maximum pressure was 772 mm. .14. The maximum average monthly variations of the barometer height is 34 mm. .30—a very high figure, which indicates that the tempestuous region extends beyond the polar circle. The barometer height is in the average maximum at the solstices, and minimum at the equinoxes, which shows that in the antarctic there is a direct and very simple relation between the barometric pressure and the sun's altitude. Winds are frequent and generally violent. Only fifty-five days of calm or very feeble wind were reckoned for a whole year. In the summer, breezes blow mostly from eastern regions; in winter from the western. It is probable that our region is already freed from the direct influence of the circular antarctic zone of western winds. The air is almost constantly saturated with watery vapour, and humidity settles down in the form of fog and snow with remarkable facility. Hoar-frost accumulates in enormous quantities upon every object—upon the ice-pack, the new ice, and even upon the falling snowflakes. During the year we counted two hundred and fifty-seven days of snowfall, and fourteen days of drizzling rain. The sky is almost constantly obscured by a cloak of grayish and low mists, which, when they sometimes happen to disappear, allow a pure sky to be seen, upon which only a few high clouds and very elongated cirri may be noticed. It would not do to generalise these observations and come to the conclusion that the whole antarctic is subject to the climatic régime which we have just described. It is very probable, on the contrary, that in the interior of the antarctic continent the sky must be very often pure, humidity lighter, and snowfalls less frequent. The *Belgica* was, in fact, imprisoned in a littoral zone, that is, in a zone where came, to be condensed itself, all the humidity brought forth by the winds of the vast

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regions of a free sea situated farther north. The south wind, or land wind, always had the effect of driving the clouds away and bringing on a dry cold. Optical phenomena were very often noticed. Splendid sunrises and sunsets, parhelia, paraselenæ, and mirage phenomena were remarkable and varied. During the whole winter austral auroras were frequent, but not remarkably vivid. One single drape-like aurora was seen; the others looked like luminous clouds traversed by moving rays.

Insolation during the summer months is considerable. On the 30th of December the thermometer with a black ball marked $+41^{\circ}$, while the temperature of the air was at -1° . The effect of that insolation is, however, but little felt upon the ice-pack; the upper layer of snow hardly melts in summer.

ICE

THE observations made with regard to this subject confirm what was already known from the examination of the arctic ice. The ice directly produced by the freezing of sea-water is never of great thickness, but this thickness increases on one side by the accumulation of snows on its surface, and on the other by the heaping of blocks during the pressure. These mechanical phenomena are able to form slabs eight metres in height. The pressures are produced, in the regions explored by the *Belgica*, by the wind, which is thus foretold: In summer, during calm weather, there is always a change in the ice-pack, which is accompanied by a formation of cracks and leads. The pressure is produced afterwards, but before the wind is felt; it generally ceases some time after the wind prevails and when the ice-pack is drifting. This seems to me to prove that the pressure is the result of difference in the velocity of the drifting parts of the ice-pack, and this difference is due to the fact that a

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wind which begins to blow drives the portion of the ice-pack on which it blows upon the rest, which has not hitherto felt its influence.

It must be said that the pressure may also be produced when the ice-pack is driven by the wind against land. The icebergs met by the expedition are incontestably formed by an ice which has a different origin from that which forms the ice-pack, properly speaking. An iceberg is indisputably a fragment of a terrestrial glacier. All the particulars which we have been able to state, concerning the structure of the floating iceberg, were equally observed in the structure of the façades of the glaciers of Belgica Strait.

OCEANOGRAPHY

A SOUNDING-LINE was much used between Staten Island and the South Shetlands. It allowed us to find out that Drake Strait is the prolongation of the oceanic basin of the Pacific. At a short distance from Staten Island the continental plateau falls abruptly from 296 metres to 1574 metres; farther south we find 4040 metres; then the bottom rises gently towards the South Shetlands, which rest themselves upon a continental plateau. These soundings bring forth an important argument for those who, like myself, believe in the independence of the American and antarctic continents. The chain of the Andes, first directed from north to south, bends or inclines towards the east to Tierra del Fuego, and takes a west-easterly direction in Staten Island. Perhaps also this curve is in the direction of the northeast through the Falkland Islands. In the same manner the chains of Grahamland are divided from southwest to northeast, and through the South Shetlands from west to east, a direction which, in the South Orkney

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Isles, leans slightly towards the southeast. It seems to me that there is here a system of divergent chains. Other people, however, connect these two chains by means of a vast hypothetical curve. It is evident that this question can only be solved by the oceanographical study of the region comprised between New Georgia of the south and Drake Strait.

In Drake Strait the temperature of the superficial sheet of water is above 0° , but below its surface the temperature descends to -1° , to ascend again from 200 metres thereabout, and maintains itself in the depths above 0° , at the bottom (3660 metres), where it is $+0.6^{\circ}$; the whole column of water cools progressively towards the south. The sheet of cold water signalled below its surface has the shape of a wedge, whose point is directed north and whose base is south. This sheet of cold water increases in thickness towards the south, and nears the surface at the same time. It is due to the presence and melting of icebergs.

In the region situated between longitudes 75° and 103° west, and from latitude 69° to latitude $71^{\circ} 30'$ south, the temperature of the water is somewhat diverse.

Above the continental plateau the superficial sheet of water has a temperature of -2° , but the temperature ascends gradually as far as the bottom, where it maintains itself between 0° and $+1^{\circ}$. The cold water occupies a greater thickness than the warm water, and this thickness increases towards the south. North of the continental plateau the temperatures of the water are nearly the same as in Drake Strait. No constant currents were observed, although the ice-pack in which the *Belgica* was inclosed was in constant motion; and though the drifting movement exceeded sometimes ten miles a day, it is not possible to establish to a certainty the existence of a current. The drifting was certainly determined by the exclusive influence of the wind,

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and I do not doubt but that a careful comparison of the successive positions of the ice-pack and mariners' cards will demonstrate it in a definite manner.

The sediments found upon the continental plateau and north of it are of a terreous origin, as stated before; but what is most remarkable is the great number of globigerinæ which are met there, and an absence of diatomaceæ. Yet the rapid examination of the plant showed a very abundant or rich flora of diatomaceæ, and almost no globigerinæ.

ZOOLOGY AND BOTANY

AS I have already remarked, the Belgica Channel lands are entirely covered with a continuous and thick cloak of ice; a few small islands, shores, and perpendicular cliffs alone show the naked rock. Upon this limited portion of antarctic land can vegetation alone develop itself; and, indeed, it does on these spots. The only floriferous plant we found is of the order *Gramineæ*, which probably belongs to the *Aira* species; but the mosses (known among others, *Barbula* and *Bryum*) and the lichens (known among others, *Lecanora*, *Verrucaria*, and *Usnea*) are more abundant. On the spots where the water oozes from the melting snows there grow some soft water-wracks—*oscillariaceæ* and *diatomaceæ*.

The terrestrial animals, properly so called, are represented by a small species of *Diptera* with rudimentary wings, podurellæ in large quantities, living with three or four species of small *Acarida* or mites among mosses and lichens. Upon soft water-wracks there rises a microscopic fauna composed of *Nematoidea*, *Rotifera*, *Tardigrada*, *Infusoria*, and *Rhizopoda*. These animals and plants represent at the present day the terrestrial antarctic fauna and flora, and no other living animal has yet been discovered upon the

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whole extent of the properly called antarctic region, for we cannot consider as terrestrial animals the birds and seals which inhabit this region. The question is to know what has become of the autochtone fauna and flora, which must have inhabited the great antarctic land and wastes during the geological periods, when the ice had not invaded the polar regions. To this question, it seems to me, there is but one answer to be made. The whole terrestrial antarctic fauna was destroyed during the glacial epochs, which, before the present epoch, covered over with ice more completely than to-day the whole antarctic region. We possess decisive information concerning the existence of a vast crystalline cap which stretched over the whole of Patagonia and Tierra del Fuego. Moreover, we observed in Belgica Channel some glacial phenomena which incontestably indicate a much greater extension of ice than the present existing one. I believe that even the plants and terrestrial animals that were found upon the lands of Belgica Strait are not the remains of the antarctic flora and fauna of the preglacial epoch, but American immigrants brought by the large-winged birds which are common to both regions.

Birds are very numerous in the Belgica Channel, and the greater part of them rest in the holes and cracks of the cliffs. With but one exception, the *Chionis alba*, all are web-footed and are a part of the orders *Gavia*, *Tubinares*, *Steganopoda*, and *Impenes*. The most common are the Dominican sea-gull (*Larus dominicanus*), the brown sea-gull (*Megalestris antarctica*), the sea-swallow (*Sterna hirundinacea*), the large petrel (*Ossifraga gigantea*), the bird of tempests (*Oceanites oceanicus*), the Cape pigeon (*Daption capensis*), the carunculated cormorant (*Phalacrocorax carunculatus*), the Papuan penguin (*Pygoscelis papua*), and the antarctic penguin (*Pygoscelis antarctica*), these latter two living in vast rookeries; in short, the curious beak-sheathed

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bird (*Chionis alba*) which, like most other birds already mentioned, nests in the holes and crevices of rocks.

Two varieties of seals were seen in Belgica Channel—the Weddell seal (*Leptonychotes weddelli*), frequently met in small bands, and the crab-eater seal (*Lobodon carcinophaga*), which is more scarce. Among the *Cetacea*, the *Megaptera boöps* (?) is met in large troops, often in the company of a large balænoptera (*Balænoptera Sibbaldii*) (?), but no genuine black or Greenland bone whale was ever seen. The littoral fauna and flora are badly represented on account of the constant motion of the ice along the rocky shores of the sea. Sea-wracks cannot fix themselves upon them, nor can animals. Yet in some well-sheltered crevices I found some rare sea-grasses (*Desmarestia*, etc.), and patellæ with small inferior animals.

The first biological example we could ascertain, during our imprisonment of thirteen months in the ice-pack, was a general presence of diatomaceæ on the superficial sheets of the sea, as well as upon icebergs and in the interior of the holes and cracks of the sea-ice. The most frequently represented species are *Chaetoceros*, *Coscinodiscus*, and *Chorethron*. The bed or plant is not very rich and but little varied. It is composed of small-sized animals, of which the most frequently represented are enumerated in the order of their frequency: the *Copepodaes Radiolaria* (*Protocystis*, *Cannosphæra*), *Pteropoda* (*Limacina*), *Polychæta* (*Pelagobia*), *Copelata* (*Oikopleura*), *Ostracoda*, *Siphonophora* (*Eudoxia*), etc.

The size of the bed or plant undergoes a season's change. During the winter, sea-ice, being very thick, intercepts daylight; in consequence the diatomaceæ cannot increase and the bed decreases considerably in size. In the summer, on the contrary, sea-ice thins, cracks, and tracks are numerous; light can thus penetrate, which accounts for an

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abundant growth of diatomaceæ, and the bed increases considerably in volume.

One of the most important *plancton* forms or plants, with regard to the part it plays in the economy of antarctic life, is a species of the *Euphausia* kind. In fact, there exist immense shoals of this animal under the ice-pack, and these shoals serve as an almost exclusive food for seals, penguins, and presumably cetaceans.

Dredgings performed upon the continental plateau spoken of elsewhere brought forth a fauna which, from its general character, shows a remarkable affinity with the abyssal fauna. We fished, in effect, pedunculated *Crinoidea*, *Elasipoda*, benthal *Asterias*, *Aselidæ*, *Pantopoda*, *Gorgonidæ*, *Polychæta*, *Cumacea*, *Mysidæ*, *Ascididæ*, which have a striking air of relationship with the similar forms fished in the great oceanic depths. This fact ought not to astonish us, for we well know that the great factor in the distribution of marine animals is temperature. Now, the temperature of the water upon this plateau of five hundred metres in depth is much the same as that of the oceanic depths. The groups best represented are the *Echinodermata*, *Crustacea* (*Edriophthalma*), *Polychæta*, *Gorgonidæ*, and *Bryozoa*. The birds which were constantly present upon the ice-pack are not numerous: the very large petrel (*Ossifraga gigantea*), the snow petrel (*Pagodroma nivea*), the antarctic petrel (*Thalassocca antarctica*), the brown sea-gull (*Megalestris antarctica*), Forster's penguin (*Aptenodytes forsteri*), and the Adelia land penguin (*Pygosulis adeliæ*).

The whole four seal species inhabiting the antarctic were seen during our stay in the ice-pack; that is, the crab-eater seal (*Lobodon carcinophaga*), Weddell sea-leopard (*Leptonychotes weddelli*), the true sea-leopard (*Ogmorhynchus leptonyx*), and Ross's seal (*Ommatophoca Rossi*). *Balænoptera* of a small size and *Ziphiidæ* came very often

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to breathe in the cracks and leads of the ice-pack. The temperature of the bodies of the seals is about $+37^{\circ}$, that of the penguins about $+40^{\circ}$. These figures are below the normal. These animals, in order to fight against the exterior cold, do not create more heat than this, only they lose less, and they arrive at this result by means of the thick covering of fat which surrounds them. Direct observations allow us to state this fact. The cold does not appear to have a pernicious influence upon the human organism. In temperatures of from -30° to -40° and calm weather, the feeling one experiences is rather pleasant and invigorating. It is naturally otherwise when the wind blows. I believe that for a traveller the great inconvenience of cold upon the ice-pack is that it creates a condensation of aqueous vapour which is eliminated by the skin's surface. At the end of a short time the clothes are all wet, and it is hard under such conditions to get warm. But the greatest inconvenience in polar regions lies in the absence of the sun during the winter months. The pernicious influence of the absence of direct sunbeams, upon the human organism, was witnessed to a certainty during the winter of 1898.

The whole crew of the *Belgica*, without exception, presented symptoms which in medical books are grouped under the name of chronic anæmia. With them all we could notice a discoloration of the mucous membranes, dyspnœa, acceleration of the pulse, dizziness, insomnia, a complete incapacity for prolonged intellectual work, and even a swelling of the legs. The report of the surgeon of the expedition promises to be interesting under this head.

I have spoken only to call attention to the studies which were made by the members of the expedition in Patagonia and Tierra del Fuego. They will bring out some zoological, botanical, geological, and anthropological contributions for the knowledge of these important regions of the globe.

APPENDIX No. II

THE ANTARCTIC CLIMATE

BY

HENRYK ARCTOWSKI

THE following is a preliminary account of some of the additions to our knowledge of the meteorology of higher southern latitudes contributed by the recent Belgian Antarctic Expedition.

These desolate antarctic regions, still so little explored, present many physical problems of the highest interest; the question of their climate, attacked as early as the time of Croll, must prove a subject of exhaustive investigation in the immediate future. The results I have obtained were not originally intended for publication in their present form, because the mean values involved can only be regarded as first approximations; however, it appears that my provisional numbers are sufficiently exact to indicate the general nature of the climatic régime in parts of the globe about which we have been, up to the present, practically without information. The fact that other antarctic expeditions are about to set out has decided me to publish my figures as they stand.

For the purposes of our inquiry, it is a matter of indifference whether an antarctic continent exists or not; we have undoubtedly to deal with a continuous surface of ice, which the meteorologist must regard as a land surface as opposed

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to an open sea. This ice-cap is entirely isolated by an ocean which surrounds it, and is subjected to the peculiar conditions of polar day and night. Hence the first points to be considered are the average distribution of pressure and the direction of the prevailing winds. The positions (about 81° and 95° west longitude, and $69^{\circ} 50'$ and $71^{\circ} 30'$ south latitude) show a relatively small distance from the open sea and great distance from the pole. In consequence we experienced two distinct types of climate according to the direction of the wind,—a continental and an oceanic,—in effect a coastal climate depending on the passage of cyclones which varied in frequency with the seasons. This seems to be the key of the whole position. As regards details, I take into consideration the mean and minimum temperatures and the barometric pressures, the direction of wind, the amount of cloud, and the amount of precipitation.

Table I. gives the mean values obtained from hourly observations of temperature made on board the *Belgica* during her drift in the ice.

July was the coldest month; its mean temperature was -23.5° C. (-10.3° F.), and the lowest temperature observed during the month, -37.1° C. (-34.8° F.). The extreme minimum of temperature was observed in September, -43.1° C. (-45.6° F.).

The warmest month was February, with a mean temperature of -1.0° C. (30.2° F.), and minimum for the month, -9.6° C. (14.7° F.).

If we regard June, July, and August as the antarctic winter months, and December, January, and February as summer, we may take it that the mean winter temperature is -16.8° C. (1.8° F.), and the mean for summer, -1.5° C. (29.3° F.).

Table II. shows the minimum temperature for each

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month. The maximum temperatures are less interesting; the winter average is -1° to 0° C. (30° to 32° F.); the absolute maximum for the equinoctial months is 0° to 1° C. (32° to 34° F.), and for summer, 2° C. (36° F.).

These tables show that between the seventieth and seventy-first parallels of the southern hemisphere, and amid the ice of the Antarctic Ocean, first, the mean temperature is lower than that of the northern coast of Spitsbergen—Mossel Bay, 1872-73, -8.9° C. (16° F.); second, the minimum temperature is quite as low as the minima observed on the east side of Greenland (Sabine Island and Scoresby Sound); and third, that the mean temperature of the three summer months is lower than the corresponding mean in the ice of the Arctic Ocean—the observations of the *Fram* give a mean for June, July, and August of -1.2° C. (29.8° F.). Note that the calculations of Spitaler and Supan give a mean temperature for the parallel of 70° north latitude of -10.2° C. (13.6° F.). If we consider that a considerable fraction of the seventieth parallel of south latitude is land, we can suppose that it may have a mean temperature as low as the seventieth degree north, and include a pole of cold with lower temperature, as the Asiatic or North American poles of cold.

As in the case of the mean temperatures, the values I am able to give for mean barometric pressure must be regarded only as first approximations. During our drift in the pack-ice hourly observations were made with a marine barometer and with an aneroid. I have not yet been able to apply exact corrections to these observations, but if we bear in mind that while the temperature correction is negative, the correction for latitude is positive, and that for temperatures about 13° to 15° C. (55° to 60° F.) these corrections are numerically nearly equal, we can accept the uncorrected values as near enough for our present

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purpose. Table III. gives the averages of the aneroid observations, calculated to whole millimetres only. The mean for the year is 744.7 mm. (29.319 inches).

Tables IV. and V. give the principal minima and maxima of pressure observed; the values are reduced to the freezing-

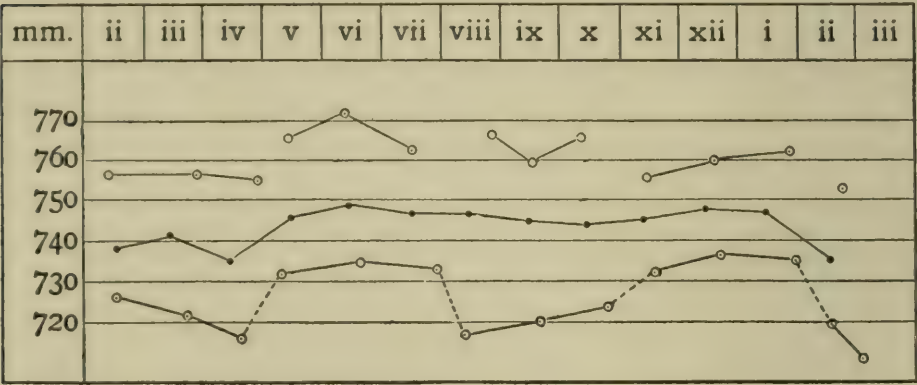


FIG. 1.

point and gravity at 45° latitude. The lowest pressure observed during our wintering was 711.74 mm. (28.022 inches), and the highest 772.14 mm. (30.400 inches), a range of 60.40 mm. (2.378 inches). Table VI. gives the monthly variations of the barometer, the mean value of which amounts to 34.30 mm. (1.350 inches), showing even more clearly than Table IV. that the cyclonic belt extends beyond the polar circle. From this table it appears, further, that the three months of almost continuous daylight (November, December, and January) are characterised by a very small variation of pressure—only 23.95 mm. (0.943 inch). The three corresponding months of winter have also a mean less than those for the intermediate or equinoctial months. Compare this with the mean pressures (Table III.). The differences between the annual and monthly means (Table VII.) show that February, March, and April form a negative group, in which the pressure is relatively low; the three months of polar night form another group of maxi-

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mum barometric pressure; then follow August, September, and October, months of decreasing pressure, a group which, although not actually negative, forms a distinct secondary minimum; and lastly, three months of polar day forming a secondary maximum of pressure. The general result is illustrated in Fig. 1,—high pressure at the solstices, low pressure at the equinoxes,—and the existence of a direct simple relation between the barometric pressure and the progress of the sun is at once obvious.

Table VIII. gives the observed wind directions: the figures indicate the number of hours during which the wind blew from each direction during the twelve months, the sums constituting the “wind-rose” of the point of observation. Fig. 2 shows that winds blow from northerly and southerly points with almost equal frequency, and that easterly winds predominate over westerly. The directions of greatest frequency were west, east, and northeast.

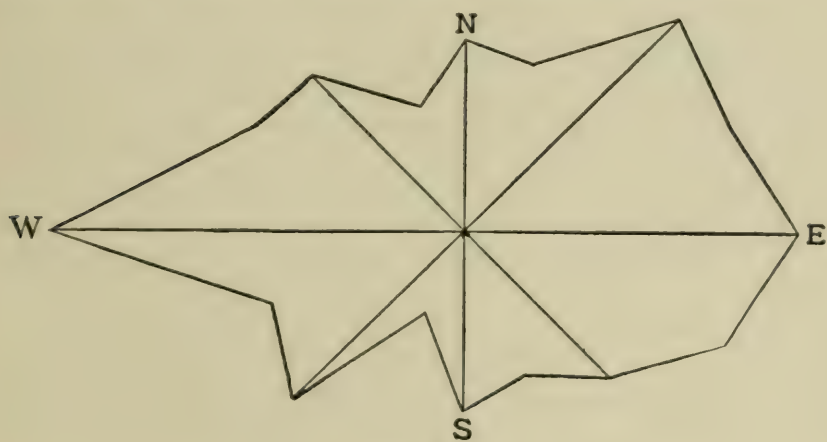


FIG. 2.

The monthly wind-roses show some interesting seasonal variations in the prevailing directions of the wind; we note specially the predominance of northeast to southeast over westerly winds from November to February, and the relative frequency of westerly winds during June, July, and

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August (Fig. 3). The figures show that, on the whole, the station was beyond the westerly wind region, although at certain seasons the westerly system did extend as far south.

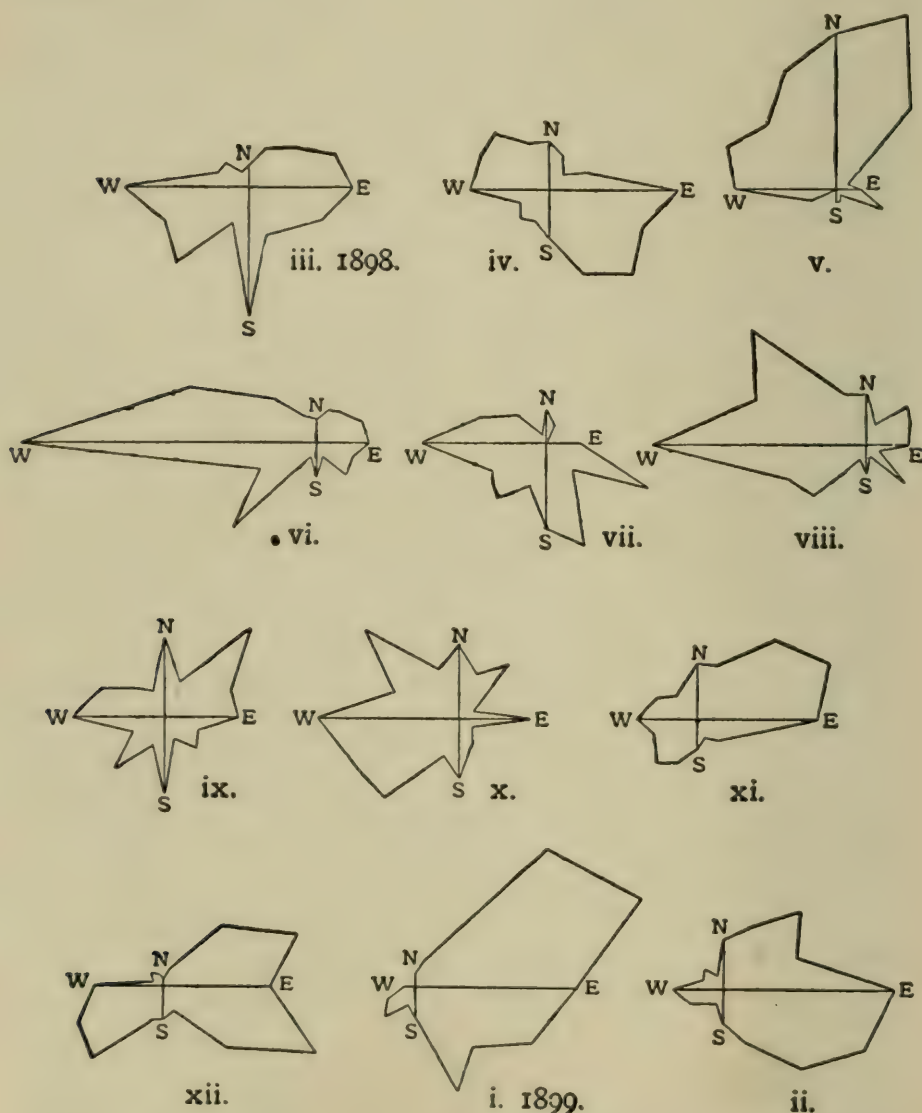


FIG. 3.

Some further points must be referred to in describing the climatic conditions we experienced. The temperature of the air is doubtless the most important element in the

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study of climate; but it seems to me that its importance is relatively less in polar regions than in other parts of the globe. In polar latitudes the human organism is chiefly influenced by the absence of the sun during the night of winter. In the summer, on the other hand, the radiant heat of the sun is so strongly concentrated that the temperature of the air scarcely measures the warmth we feel. Further, the action of the solar rays is directly beneficial—the sun strengthens and reanimates. And besides direct insolation, the diffused daylight itself must be considered. One feels quite different under a cloudless vault and under a sky overcast and sombre. The presence or absence of the sun is a much more important matter to us than the state of the thermometer.

The wind is another extremely important factor from the physiological point of view. In calm weather a temperature of -20° C. (-4° F.) is quite tolerable, even agreeable if the sun is shining; but with a light breeze one feels the cold at once, and in strong wind it is impossible to remain long in the open air with so low a temperature. It appears to me that humidity plays a quite secondary part in the physiology of the polar climate—at least, at low temperatures; in any case, the humidity of the atmosphere rarely makes itself felt.

Some actinometric observations will serve to indicate the intensity of radiant heat. At 2 P. M. on December 30, the temperature of the air being -0.2° C. (31.6° F.), the black-bulb thermometer read 45.1° C. (113.2° F.) in the sun, which explains why in reality the weather felt very warm.

The sky was usually overcast, most frequently with a thick layer of stratus, which formed a uniform gray covering, and often persisted for days or even weeks together, with only short breaks. Table IX. shows the state of the sky during each month of the year.

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The number of days during which the air was not saturated, i.e., on which the hygrometer indicated humidity less than ninety per cent., was, in October, 12; November, 18; December, 22; January, 15; and February, 11.

If we include ice-deposits from fog and similar precipitation, we find that snowfall is recorded on 257 days of the year, made up as shown on the first column of Table X. The second column of Table X. shows the number of days on which rain (even a few drops) was recorded. Speaking generally, it may be said that the weather was extremely cloudy, that fogs were frequent, that snow fell on many days, and that the air was saturated nearly the whole time.

Table XI. gives particulars with regard to wind force.

TABLE I.—MEAN TEMPERATURE.

	°C	°F
1898. March	— 9.1	15.6
April.....	— 11.8	10.8
May	— 6.5	20.3
June.....	— 15.5	4.1
July	— 23.5	— 10.3
August.....	— 11.3	11.7
September	— 18.5	— 1.3
October.....	— 7.9	17.8
November	— 6.0	19.6
December.....	— 2.2	28.0
1899. January.....	— 1.2	29.8
February.....	— 1.0	30.2
Year.....	— 9.6	14.7

TABLE II.—MONTHLY MINIMA OF TEMPERATURE.

	°C	°F
1898. February 23, at 10 p.m.	— 7.6	18.3
March 15, at 4 a.m.	— 20.3	— 4.5
April 3, at 6 p.m.	— 26.5	— 15.7
May 29, at 8 p.m.	— 25.2	— 13.4
June 3, at 6 p.m.	— 30.0	— 22.0
July 17, at 10 p.m.	— 37.1	— 34.8
August 28, at 3 a.m.	— 29.6	— 21.3
September 8, at 4 a.m.	— 43.1	— 45.6
October 25, at 3 a.m.	— 26.3	— 15.3
November 2, at 4 a.m.	— 21.4	— 6.5
December 2, midnight	— 14.5	5.9
1899. January 2, at 2 a.m.	— 8.1	17.4
February 11, at 2 a.m.	— 9.6	14.7
March 4, midnight.....	— 12.0	10.4

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TABLE III.—MONTHLY MEANS (APPROXIMATE) OF BAROMETRIC PRESSURE.

	MM.	INCHES.
1898. February*.....	738.5	29.075
March.....	741.4	29.160
April.....	735.6	28.961
May.....	746.3	29.382
June.....	749.5	29.508
July.....	747.8	29.441
August.....	747.2	29.418
September.....	745.5	29.351
October.....	744.7	29.319
November.....	746.0	29.371
December.....	748.2	29.457
1899. January.....	747.3	29.422
February.....	736.5	28.997
Year.....	744.7	29.319

* Latter half of month only.

TABLE IV.—MINIMUM PRESSURES OBSERVED.

	REDUCED TO FREEZING- POINT.		REDUCED TO FREEZING- POINT AND LAT. 45°.	
	MM.	INCHES.	MM.	INCHES.
1898. February 18, at 6 a.m.....	724.53	28.526	725.93	28.581
March 22, at 4 a.m.....	719.96	28.345	721.48	28.405
April 20, at 3 a.m.....	714.66	28.136	716.15	28.195
May 10, at 11 p.m.....	730.26	28.751	731.78	28.811
June 21, at 1 a.m.....	733.58	28.881	735.11	28.941
July 31, at 2 a.m.....	731.77	28.811	733.28	28.870
August 12, at 4 a.m.....	715.81	28.182	717.31	28.241
September 22, at 6 a.m.....	719.29	28.319	720.77	28.377
October 23, at 4 a.m.....	722.06	28.428	723.53	28.486
November 19, at 3 p.m.....	731.33	28.793	732.82	28.852
December 22, at 10 p.m.....	735.52	28.958	737.01	29.016
1899. January 30, at 10 p.m.....	733.92	28.895	735.43	28.955
February 17, at 11 p.m.....	718.59	28.292	720.08	28.350
March 2, at 3 a.m.....	710.26	27.963	711.74	28.022

Absolute minimum, 711.74 mm. = 28.022 inches.

TABLE V.—MAXIMUM PRESSURES OBSERVED.

	REDUCED TO FREEZING- POINT.		REDUCED TO FREEZING- POINT AND LAT. 45°.	
	MM.	INCHES.	MM.	INCHES.
1898. February 11, at 4 p.m.....	755.82	29.757	757.11	29.808
March 29, at 1 a.m.....	755.35	29.739	756.95	29.802
April 26, at 7 a.m.....	753.80	29.678	755.37	29.739
May 13, at 4 p.m.....	764.28	30.090	765.90	30.154
June 11, at 1 a.m.....	770.48	30.334	772.14	30.400
July 18, at 8 p.m.....	761.53	29.983	763.10	30.044
August 29, at 6 p.m.....	765.43	30.135	766.99	30.197
September 16, at 9 p.m.....	757.77	29.834	759.31	29.894
October 12, at 8 a.m.....	764.80	30.111	766.35	30.172
November 13, at 4 a.m.....	754.05	29.688	755.58	29.748
December 18, at 5 a.m.....	757.65	29.829	759.20	29.890
1899. January 24, at 8 p.m.....	760.76	29.951	762.33	30.013
February 22, at 3 a.m.....	751.63	29.593	753.17	29.653

Absolute maximum, 772.14 mm. = 30.400 inches.

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TABLE VI.—MAXIMUM VARIATIONS OF PRESSURE, AND MEANS OF THOSE VARIATIONS.

	MM.	INCH.
1899. February	33.09	1.303
1898. March	35.47	1.397
April	39.22	1.544
May	34.12	1.343
June	37.03	1.458
July	29.82	1.174
August	49.68	1.955
September	38.54	1.518
October	42.82	1.686
November	22.76	0.897
December	22.19	0.874
1899. January	26.90	1.059
Mean	34.30	1.350

Extreme range for the year: 772.14 — 711.74 = 60.40 mm.
30.400 — 28.022 = 2.378 inches.

TABLE VII.—DIFFERENCES OF MONTHLY MEANS OF PRESSURE FROM THE MEAN OF THE YEAR.

The + sign indicates pressure greater than the mean, the — sign pressure less than the mean.

	MM.	INCH.
1899. February	— 8.2	— 0.323
1898. March	— 3.3	— 0.130
April	— 9.1	— 0.358
May	+ 1.6	+ 0.063
June	+ 4.8	+ 0.189
July	+ 3.1	+ 0.122
August	+ 2.5	+ 0.098
September	+ 0.8	+ 0.031
October	0.0	0.000
November	+ 1.3	+ 0.051
December	+ 3.5	+ 0.138
1899. January	+ 2.6	+ 0.102

TABLE VIII.—TABLE OF WIND DIRECTIONS.

The figures show the number of hours during which the wind blew from each direction.

	N.	N.N.E.	N.E.	E.N.E.	E.	E.S.E.	S.E.	S.S.E.	S.	S.S.W.	S.W.	W.S.W.	W.	W.N.W.	N.W.	N.N.W.
1898.																
March	14	26	38	60	68	50	34	30	82	22	64	56	78	22	22	10
April	30	22	13	27	84	64	76	59	32	21	25	20	51	49	50	31
May	100	121	72	8	17	33	4	7	9	1	2	17	65	75	61	83
June	14	22	26	33	34	25	28	9	24	8	76	38	191	87	37	16
July	22	10	1	—	24	72	31	70	54	28	48	38	81	48	25	4
August	32	14	38	29	26	9	34	5	19	10	47	56	141	76	104	38
Sept.	51	24	74	44	46	22	28	14	49	16	47	21	59	45	24	17
Oct.	47	31	46	8	45	11	7	18	41	24	69	74	91	42	83	32
Nov.	34	35	69	93	79	32	21	14	21	31	37	28	38	28	18	21
Dec.	3	12	53	92	67	107	55	16	21	24	63	58	44	5	11	7
1899.																
Jan.	8	16	124	156	104	84	52	72	20	12	28	16	8	—	—	—
Feb.	32	42	70	49	111	99	72	37	22	10	13	23	35	13	17	6
	387	375	624	599	705	608	442	351	394	207	519	445	882	490	452	265

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TABLE IX.

Column 1 shows number of days of continuous fog or overcast sky.

Column 2 shows number of days with sky partially clear for several hours in succession (cloud amount 30 per cent. or more).

Column 3 shows number of days on which fog was observed.

	1	2	3
March	6	15	14
April	10	14	26
May	15	8	27
June	5	16	28
July	7	22	17
August	9	15	25
September	9	14	14
October	16	12	23
November	13	10	18
December	9	13	13
January	17	6	17
February	21	1	23

TABLE X.

Column 1 shows the number of days on which snow was recorded.

Column 2 shows the number of days on which rain was recorded.

	1	2
March	13	—
April	22	—
May	30	4
June	24	—
July	14	—
August	26	1
September	19	—
October	25	2
November	25	—
December	18	—
January	19	4
February	22	3
Year	257	14

TABLE XI.

Column 1 shows the number of days of calm, or of wind not exceeding force 1.

Column 2 shows the number of days of wind force less than 4.

	1	2
March	0	11
April	2	5
May	3	13
June	3	11
July	15	25
August	3	15
September	7	20
October	4	11
November	8	21
December	4	21
January	5	24
February	1	12

APPENDIX No. III

THE BATHYMETRICAL CONDITIONS OF THE ANTARCTIC REGIONS

BY

HENRYK ARCTOWSKI

THE scientific work of the Belgian Antarctic Expedition was commenced in the channels of Tierra del Fuego, and after the vessel left the pack they were concluded at Punta Arenas. It is thus impossible to discuss the physical geography of the antarctic regions in general without including the scientific results of the expedition of the *Belgica*.

The works of Murray, Neumayer, Fricker, and others,¹ give a general account of the previous state of our knowledge of the antarctic regions, and therefore I prefer to give a short summary of the results obtained by the Belgian Antarctic Expedition from the point of view of oceanography.

¹ G. Neumayer, "Die Erforschung des Süd-Polar Gebietes." Berlin, 1872.

G. Neumayer, "Ueber Südpolarforschung" (Report of the Sixth International Geographical Congress, London, 1895).

Sir John Murray, "The Renewal of Antarctic Exploration" ("Geographical Journal," January, 1894); and the "Narrative" of the *Challenger* Reports.

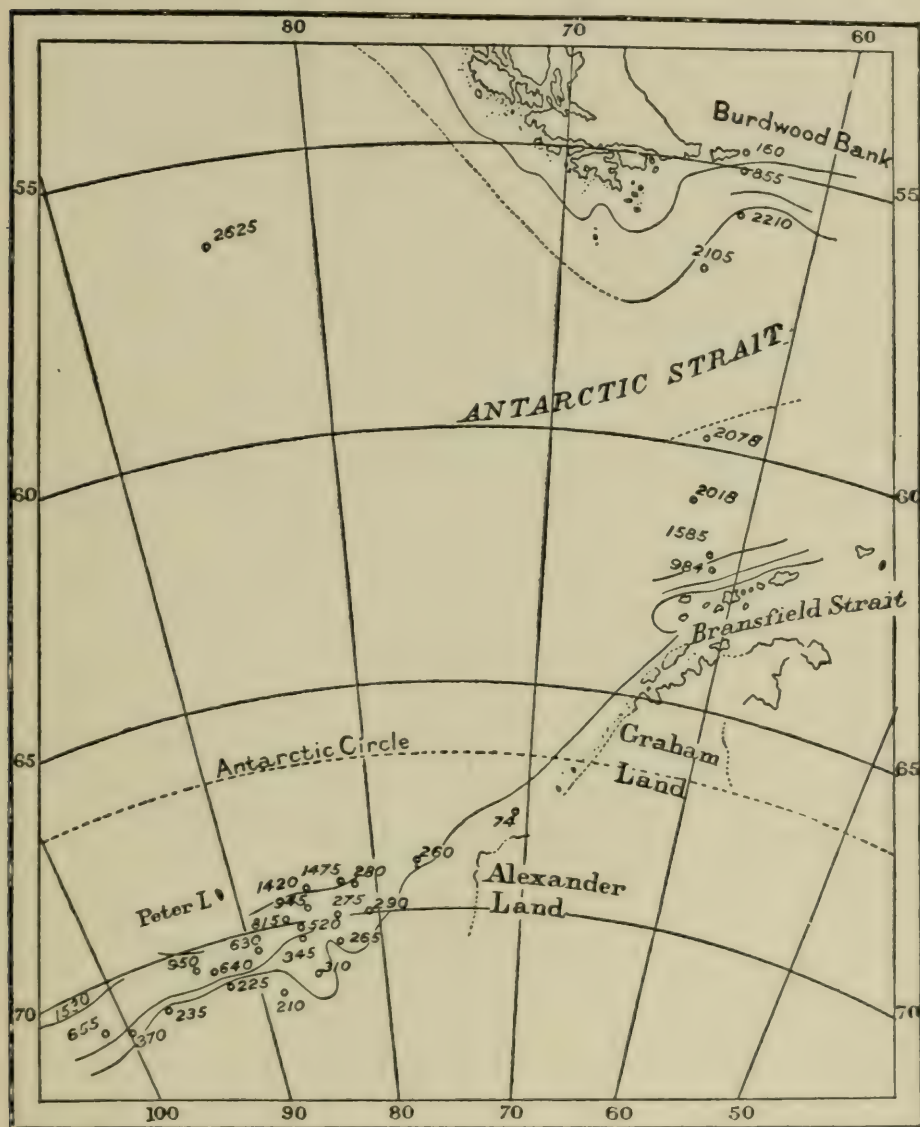
K. Fricker, "Entstehung und Verbreitung des Antarktischen Treibeises." Leipzig, 1893.

K. Fricker, "Antarktis." Berlin, 1898.

For bibliography, see T. Chavanne, "Die Literatur über die Polar-Regionen der Erde" (Wien, 1878); and the Antarctic Number of the "Scottish Geographical Magazine" (October, 1898).

BATHYMETRICAL CONDITIONS

The *Belgica* had the advantage of navigating a region in which no previous bathymetric researches had been made, and her soundings have a special value (although their



actual number was not great) because they were not taken at random. On the voyage from Staten Island to the South Shetlands, a line of soundings was run nearly from

BATHYMETRICAL CONDITIONS

north to south, giving a transverse section of the " antarctic channel " which separates the Andes from one of the projecting angles of Murray's hypothetical antarctic continent. In another place also, beyond the antarctic circle, and to the west of Alexander I. Land, we were able to obtain a series of soundings, some before entering the ice, the others on account of the drift of the vessel when imprisoned in the pack. The soundings on our way southward are given in the Table as Nos. 1-9, and those taken between 70° and 107° west as Nos. 10-56, while the results are represented chartographically in the two maps.

The first map shows the probable arrangement of the depths to the south of Cape Horn and in the antarctic regions. Soundings Nos. 1, 2, and 3 prove that south of Staten Island the continental shelf is very narrow, and terminates seaward in an abrupt slope, the greatest depth sounded (2209 fathoms) lying, in fact, very near the island. To the east, on the contrary, the continental shelf extends to a great distance as Burdwood Bank.

Between the southern versant of the Andes and the mountain system forming the framework of the antarctic lands visited by the expedition, there lies a deep, flat-bottomed depression, the floor of which rises gently towards the south, and not far from the South Shetlands an abrupt slope leads up to the rocky shallows near Livingstone Island. The last sounding taken gave a depth of 2625 fathoms in $56^{\circ} 28'$ south and $84^{\circ} 46'$ west, proving that the depth increases towards the Pacific Ocean. As, on the contrary, the Sandwich group, South Georgia, and Shag Rocks lie to the east, it seems probable that this great basin (called Barker Basin on the chart in the *Challenger* Reports) does not extend to the east of these islands. In a note on the interest which attaches to the geological exploration of the lands in the far south, which I published in December,

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1895,¹ I suggested that "Grahamland is connected with Patagonia by a submarine ridge, which forms a great arc extending between Cape Horn and the South Shetland Islands, and that the tertiary chain of the Andes reappears in Grahamland." I maintain this hypothesis, which demands for its satisfactory demonstration not only the geological study of the land, but also and chiefly a detailed bathymetrical map. The first step to this end has now been made.

The second map, showing soundings in the pack, is on a larger scale than the first, and shows the distribution of the soundings to the west of the land, and within the antarctic circle. It clearly demonstrates the presence of a continental shelf. The section along the line *AB* is extremely characteristic, showing distinctly that the submarine slope is discontinuous. The submerged bank, which terminates abruptly towards the ocean, has depths of from 200 to 300 fathoms, and farther south the depths are probably still less. I shall not discuss the configuration of this submarine elevation as one might imagine it to be from the soundings taken upon it, for the soundings are not numerous enough for this to be done profitably. But I cannot refrain from calling attention to one point which seems to me of great importance. The edge of the plateau is indicated by the isobath of 300 fathoms, beyond which the depths increase very rapidly. Now, it is the 100-fathom line which is generally accepted as the limit of the continental shelf, and it would appear possible that in the antarctic regions the continental shelf had been submerged. The discussion of this interesting question would, however, lead us too far.

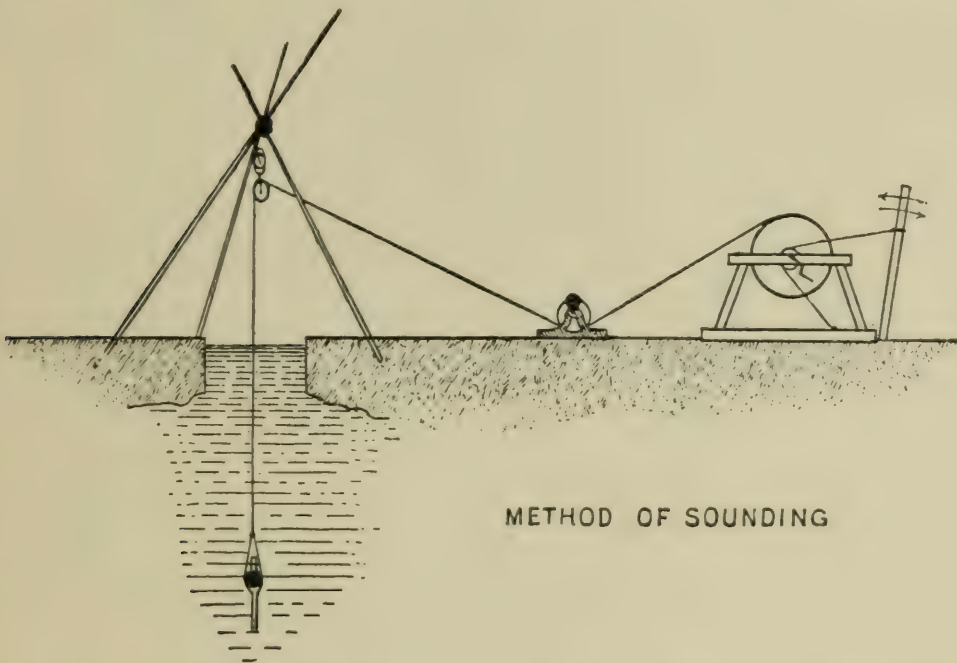
It is noteworthy that the soundings carried out by the *Erebus* and *Terror* to the east of Victorialand, and north

¹ Bull. Soc. Géol. de France [3], xxiii, p. 589.

BATHYMETRICAL CONDITIONS

of the ice-barrier discovered by Ross, also indicate the existence of a continental shelf with much greater depths to the north. Between the two there still remains a space of 60° of longitude to explore before one can say whether they are connected.

All the positions were fixed by M. Lecointe, and I am indebted to the kindness of this accomplished astronomer



for the exact place of each sounding. The sounding-machine of the *Belgica* was constructed by Le Blanc at Paris, and is similar to that employed on the *Pola* by the Austrian expedition. During the wintering in the ice, M. de Gerlache had a simple but effective arrangement constructed on board, which was fitted up on the ice close to the ship, and only required a hole to be cut in order to allow a sounding to be made. It consisted of a wooden drum carrying the sounding-wire, a brake consisting of a cord and a strong piece of wood serving as a lever to regulate the descent of the weight, and two cranks on the axle of

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the drum to heave in the wire. A wheel of one metre in circumference, with a counter from the Le Blanc machine, allowed the depth to be read off. The line ran through a block attached by a dynamometer to three poles arranged as a tripod. The soundings and temperature observations were laborious, and it is due to the co-operation of MM. Amundsen, Tollefsen, Johansen, Melaerts, Van Rysselberghe, and of M. de Gerlache himself, that it has been made possible for me to write these notes on the bathymetrical conditions of the antarctic regions.

TABLE OF SOUNDINGS.

DATE.	DEPTH IN METRES.	FATHOMS.	LATITUDE.	LONGITUDE WEST.	No.
1898.			0 /	0 /	
Jan. 14	296	162	54 51	63 37	1
" 14	1564	855	55 3	63 29	2
" 15	4040	2209	55 51	63 19	3
" 16	3850	2105	56 49	64 30	4
" 18	3800	2078	59 58	63 12	5
" 19	3690	2018	61 5	63 4	6
" 20	2900	1586	62 2	61 58	7
" 20	1880	1028	62 11	61 37	8
" 28	625	342	64 23	62 2	9
Feb. 16	135	74	67 59	70 40	10
" 19	480	262	69 6	78 21	11
" 23	565	309	69 46	81 8	12
" 24	510	279	69 31	81 31	13
" 25	2700	1476	69 17	82 25	14
" 27	2600	1422	69 24	84 39	15
" 27	1730	946	69 41	84 43	16
Mar. 1	570	312	71 6	85 23	17
" 1	520	284	71 17	85 43	18
" 2	460	251	71 31	85 16	19
" 4	530	290	71 22	84 55	20
" 5	520	284	71 19	85 29	21
" 9	554	303	71 23	85 33	22
" 20	390	213	71 35	88 2	23
April 22	480	262	71 2	92 3	24
" 26	410	224	70 50	92 22	25
May 4	1150	629	70 33	89 22	26
" 20	435	238	71 16	87 38	27
" 26	436	238	71 13	87 44	28
Sept. 2	502	274	70 0	82 45	29
" 9	510	279	69 51	82 36	30
" 14	480	262	69 53	83 4	31
" 22	485	265	70 23	82 31	32
" 26	485	265	70 21	82 52	33
" 29	480	262	70 21	82 39	34
Oct. 7	480	262	70 30	82 48	35
" 16	532	291	69 59	80 54	36

BATHYMETRICAL CONDITIONS

TABLE OF SOUNDINGS. — (*Continued.*)

DATE.	DEPTH IN METRES.	FATHOMS.	LATITUDE.	LONGITUDE WEST.	No.
1898.			° /	° /	
Oct. 19	580	317	70 1	81 45	37
" 24	537	294	69 43	80 51	38
Nov. 2	518	283	69 51	81 24	39
" 10	490	268	70 9	82 35	40
" 28	459	251	70 20	83 23	41
Dec. 20	569	311	70 15	84 6	42
" 22	645	253	70 19	84 51	43
" 27	630	344	70 20	85 52	44
" 29	660	361	70 15	85 51	45
" 31	950	519	70 1	85 20	46
1899.					
Jan. 2	1360	744	69 52	85 13	47
" 4	1470	804	69 50	85 12	48
" 7	1490	815	69 52	85 32	49
Feb. 10	1166	638	70 34	93 17	50
" 19	1740	951	70 30	94 12	51
Mar. 2	430	235	70 53	97 17	52
" 5	425	232	70 51	97 57	53
" 12	564	308	70 56	100 18	54
" 13	1195	653	70 50	102 14	55
" 23	4800	2625	56 28	84 46	56

APPENDIX No. IV

NAUTICAL POSITIONS AND MAGNETIC DEDUCTIONS

BY
CAPTAIN GEORGES LECOINTE

DATES.	LOCAL TIME.	LATITUDE SOUTH.	LONGITUDE WEST OF GREENWICH.	TEMPERATURE CENTIGRADE.	DECLINATION.	INCLINATION.
Jan. 2	5.30 p.m.	69° 52' 00''	85° 13' 30''	— 1.6	34.22	68.27
Jan. 7	9 a.m.	69° 52' 00''	85° 32' 15''	— 2.8	34.21	68.27
Jan. 14	12 m.	54° 50' 40''	63° 39' 00''			
Jan. 14	5 p.m.	55° 02' 50''	63° 29' 15''			
Jan. 15	12 m.	55° 50' 45''	63° 19' 15''			
Jan. 16	12 m.	56° 47' 30''	64° 23' 45''			
Jan. 16	5 p.m.	56° 48' 45''	64° 30' 30''			
Jan. 17	5 p.m.	58° 43' 30''	63° 43' 15''			
Jan. 18	12 m.	59° 58' 15''	63° 12' 15''			
Jan. 19	12 m.	61° 05' 30''	63° 04' 15''			
Jan. 20	12 m.	62° 02' 15''	61° 58' 15''			
Jan. 20	4 p.m.	62° 11' 00''	61° 37' 15''			
Jan. 23	12 m.	63° 28' 30''	62° 13' 00''			
Jan. 24	12 m.	64° 09' 00''	62° 13' 00''			
Jan. 25	10 a.m.	64° 06' 24''	61° 59' 30''			
Jan. 25	3 p.m.	63° 57' 04''	61° 47' 34''			
Jan. 27	7 a.m.	64° 02' 26''	61° 35' 20''			
Jan. 27	12 m.	64° 09' 00''	61° 35' 20''			
Jan. 28	8 a.m.	64° 22' 45''	62° 02' 15''			
Jan. 30	8 a.m.	64° 31' 15''	62° 21' 45''			
Feb. 5	12 m.	64° 27' 45''	62° 27' 45''			
Feb. 8	12 m.	64° 38' 00''	62° 27' 45''			
Feb. 9	7 a.m.	64° 47' 15''	63° 29' 25''			
Feb. 9	12 m.	64° 54' 23''	63° 39' 10''	— 2.	38.20	70.09
Feb. 10	8 a.m.	70° 33' 45''	93° 17' 00''	— 6.8	38.20	70.30
	7.15 to 8 p.m.			— 4.5		70.14
	8 to 8.30 p.m.			— 4.5		70.22
	8 p.m.			— 4.5		70.27
Feb. 11	9 a.m.	65° 04' 25''	63° 00' 15''			
Feb. 12	10 a.m.	65° 01' 30''	63° 49' 25''			
Feb. 16	12 m.	67° 58' 15''	70° 03' 15''			
Feb. 18	4 p.m.	67° 59' 30''	70° 39' 30''			
Feb. 19	12 m.	69° 06' 15''	78° 21' 30''	— 0.8	39.16	70.07
Feb. 22	9 p.m.	69° 48' 45''	81° 08' 30''			

OBSERVATIONS BY LECOINTE

DATES.	LOCAL TIME.	LATITUDE SOUTH.	LONGITUDE WEST OF GREENWICH.	TEMPERATURE CENTIGRADE.	DECLINATION.	INCLINATION.
Feb. 23	12 m.	69° 46' 30"	81° 08' 30"			
Feb. 24	12 m.	69° 30' 30"	81° 31' 30"			
Feb. 25	3 p.m.	69° 17' 00"	82° 24' 30"			
Feb. 26	12 m.	69° 13' 30"	82° 20' 30"			
Feb. 27	12 m.	69° 24' 00"	84° 39' 15"			
Feb. 27	5 p.m.	69° 40' 45"	84° 42' 30"			
Feb. 28	12 m.	70° 23' 00"	85° 56' 45"			
Mar. 1	8 a.m.	71° 06' 00"	85° 22' 45"			
Mar. 1	12 m.	71° 04' 45"	85° 22' 45"			
Mar. 1	4 p.m.	71° 17' 00"	85° 26' 00"			
Mar. 2	12 m.	71° 31' 15"	85° 15' 45"	+ 0.6	40.41	71.17
Mar. 2	3.30 p.m.		97° 16' 15"	+ 0.2	40.32	71.15
Mar. 3	12 m.	71° 28' 00"	85° 11' 15"		35.10	
Mar. 4	12 m.	71° 22' 15"	84° 54' 45"	+ 10.4	41.07	71.17
Mar. 5	12 m.	71° 19' 00"	85° 28' 30"			
Mar. 6	4 p.m.	71° 18' 30"	85° 34' 45"	- 6.7		71.32
Mar. 7	12 m.	71° 26' 30"	85° 44' 00"			
Mar. 7	9 p.m.	71° 29' 15"	85° 55' 15"			
Mar. 8	4 p.m.	71° 28' 30"	85° 54' 30"			
Mar. 9	12 m.	71° 23' 00"	85° 32' 00"			
Mar. 11	12 m.	71° 23' 15"	85° 38' 30"			
Mar. 12	12 m.	71° 24' 45"	85° 53' 15"	- 12.5	41.47	71.56
Mar. 13	12 m.	71° 19' 15"	86° 02' 15"			
Mar. 14	4 p.m.	71° 16' 15"	85° 37' 00"			
Mar. 15	12 m.	70° 52' 15"	85° 37' 00"			
Mar. 20	3 p.m.	71° 35' 00"	88° 02' 00"			
Mar. 23	12 m.	71° 34' 45"	88° 50' 45"	- 13.2	38.56	
Mar. 24	12 m.	71° 35' 15"	88° 50' 45"			
Mar. 25	12 m.	71° 24' 15"	88° 32' 00"			
Mar. 26	12 m.	71° 19' 45"	88° 23' 00"			
Mar. 27	12 m.	71° 16' 30"	88° 23' 00"			
Mar. 28	12 m.	71° 13' 00"	88° 23' 15"			
Mar. 30	8 a.m.	71° 13' 00"	88° 06' 15"			
Apr. 2	12 m.	71° 09' 30"	88° 06' 15"			
Apr. 3	12 m.	71° 07' 03"	88° 06' 15"			
Apr. 5	12 m.	71° 04' 15"	88° 06' 15"			
Apr. 7	7 p.m.	70° 54' 45"	88° 42' 00"			
Apr. 8	12 m.	70° 53' 04"	88° 42' 00"			
Apr. 10	12 m.	70° 52' 04"	88° 42' 00"			
Apr. 11	12 m.	70° 48' 15"	88° 42' 00"			
Apr. 21	12 m.	71° 03' 18"	88° 42' 00"			
Apr. 21	8 p.m.	71° 02' 00"	92° 03' 15"			
Apr. 22	2 p.m.					
Apr. 25	10 p.m.	70° 50' 15"	92° 21' 30"	- 24.5	36.51	
Apr. 26	8 a.m.					
Apr. 30	10 p.m.	70° 43' 30"	90° 30' 45"			
May 4	7 a.m.	70° 33' 30"	89° 22' 00"			
May 5	11 a.m.					
May 10	11 a.m.					
May 16	4 p.m.	71° 34' 30"	89° 10' 00"			
May 17	7 p.m.	71° 22' 00"	88° 39' 49"			
May 18	8 p.m.	71° 17' 45"	88° 02' 15"			
May 20	7 p.m.	71° 15' 45"	87° 38' 15"			
May 21	8 p.m.	71° 15' 15"	87° 26' 30"			
May 25	7 p.m.	71° 13' 15"	87° 44' 00"			
May 26	11 a.m.					
May 26	7 p.m.	71° 15' 00"	87° 39' 15"			
May 29	7 p.m.	71° 23' 45"	87° 35' 00"	- 25.		70.07
May 31	7 a.m.	71° 36' 00"	87° 38' 30"	- 9.		70.14

APPENDIX No. IV

DATES.	LOCAL TIME.	LATITUDE SOUTH.	LONGITUDE WEST OF GREENWICH.	TEMPERATURE CENTIGRADE.	DECLINATION.	INCLINATION.
June 1	7 p.m.	71° 25' 15"	86° 55' 15"			
June 2	10.30 a.m.	71° 25' 15"	86° 55' 15"	— 28.1		69.38
June 3	7 p.m.	71° 23' 00"	87° 22' 15"	— 27.4		69.18
June 7	7 p.m.	71° 23' 30"	86° 55' 15"			
June 8	7 p.m.	71° 21' 30"	87° 50' 00"			
June 10	7 p.m.	71° 20' 00"	87° 16' 00"			
June 14	5 p.m.	71° 04' 00"	86° 03' 00"	— 27.1	35 34	69.02
June 15	9 p.m.	71° 04' 00"	86° 36' 45"			
June 22	8 a.m.	70° 56' 15"	83° 30' 15"	— 27.2	34.04	68.09
June 22	8 p.m.	70° 56' 15"	83° 30' 00"			
June 23	7 p.m.	70° 47' 45"	83° 43' 45"			
July 7	11 p.m.	70° 51' 00"	86° 47' 15"			
July 8	9 p.m.	70° 48' 30"	87° 14' 00"			
July 9	9 p.m.	70° 54' 15"	88° 19' 00"	— 32.6	37.04	69.15
July 21	3 p.m.	70° 35' 15"	86° 34' 15"	— 29.3	35.38	69.23
Aug. 10	7 p.m.	70° 52' 30"	86° 33' 30"			
Aug. 19	7 p.m.	70° 26' 00"	84° 26' 15"			
Aug. 20	6 p.m.	70° 72' 15"	84° 03' 30"			
Aug. 22	6 p.m.	70° 09' 15"	83° 41' 15"			
Aug. 24	6 p.m.	70° 15' 30"	83° 15' 15"			
Aug. 26	7 p.m.	70° 16' 00"	83° 15' 00"			
Aug. 27	12 m.	70° 16' 00"	83° 15' 00"			
Aug. 29	7 p.m.	70° 13' 15"	83° 26' 45"			
Aug. 31	7 p.m.	70° 04' 30"	83° 06' 30"			
Sept. 2	7 p.m.	70° 00' 15"	82° 45' 00"	— 23.	33.13	68.38
Sept. 2	8.40 p.m.	70° 00' 15"		— 23.5	33.19	67.16
Sept. 3	11 a.m.	69° 58' 45"	82° 38' 45"	— 15.6	33.28	67.52
Sept. 4	2 to 3 p.m.			— 20.5		68.09
	3 p.m.			— 20.5		68.07
	4.30 p.m.			— 20.3		67.45
Sept. 5	7 p.m.	69° 59' 16"	82° 43' 45"			
Sept. 7	12 m.	69° 53' 45"				
Sept. 7	7 p.m.	69° 54' 00"	82° 35' 15"	— 33.3	33.06	67.45
Sept. 8	7 p.m.	69° 53' 45"	82° 38' 30"			
Sept. 9	7 p.m.	69° 51' 00"	82° 36' 15"	— 38.5	33.11	68.23
Sept. 9	4.30 p.m.			— 32.2		68.16
Sept. 10	7 p.m.	69° 51' 45"	82° 40' 45"			
Sept. 11	12 m.	69° 51' 30"	32° 40' 45"			
Sept. 13	7 p.m.	69° 50' 15"	83° 03' 00"	— 32.7	33.17	67.58
Sept. 14	1 p.m.	69° 53' 00"	83° 03' 30"			
Sept. 14	6 p.m.	69° 55' 30"	83° 04' 15"			
Sept. 16	7 p.m.	69° 51' 15"	82° 22' 45"			
Sept. 22	3 p.m.	70° 22' 45"	82° 31' 00"	— 4.8	33.40	68.13
Sept. 23	4 p.m.	70° 24' 30"	82° 37' 00"	— 13.1	33.45	67.56
Sept. 26	12 m.	70° 21' 15"	82° 52' 15"	— 15.2	33.58	68.06
Sept. 26	3.45 p.m.			— 15.2		68.07
Sept. 29	12 m.	70° 21' 00"	82° 39' 00"	— 21.5	33.45	68.10
	2.30 to 3.30 p.m.			— 18.1		68.22
Oct. 6	12 m.	70° 38' 30"	82° 39' 00"			
Oct. 7	12 m.	70° 30' 30"	82° 48' 00"	— 14.5	33.42	68.20
Oct. 8	12 m.	70° 23' 30"	82° 46' 45"	— 15.1	33.12	68.17
Oct. 10	12 m.	70° 09' 15"	82° 42' 30"	— 6.2	33.29	68.02
Oct. 16	12 m.	69° 59' 00"	80° 54' 15"	— 6.0	33.16	67.40
Oct. 19	5 p.m.	70° 01' 30"	80° 44' 45"			
Oct. 20	12 m.	70° 00' 30"	80° 44' 45"			
Oct. 21	12 m.	69° 56' 15"	80° 44' 45"			
Oct. 22	8 a.m.	69° 55' 00"	80° 31' 00"	— 16.	32.11	67.22
Oct. 23	12 m.	69° 50' 15"				

OBSERVATIONS BY LECOINTE

DATES.	LOCAL TIME.	LATITUDE SOUTH.	LONGITUDE WEST OF GREENWICH.	TEMPERA- TURE CEN- TIGRADE.	DECLINA- TION.	INCLINA- TION.
Oct. 24	12 m.	69° 43' 00"	80° 50' 30"	— 19.3	32.00	67.32
Oct. 25	12 m.	69° 38' 45"	80° 36' 30"	— 19.8	31.55	67.13
Oct. 28	12 m.	69° 39' 30"	80° 36' 30"			
Oct. 29	12 m.	69° 38' 00"	80° 35' 30"	— 15.7	31.50	67.37
	11 a.m.			— 12.		67.22
Oct. 30	12 m.	69° 44' 45"	80° 35' 30"			
Nov. 2	12 m.	69° 51' 00"	81° 26' 00"	— 13.0	32.21	68.22
Nov. 2	4 p.m.	69° 51' 15"	81° 23' 45"			
Nov. 3	12 m.	69° 48' 15"	81° 19' 00"			
Nov. 3	5 p.m.	69° 47' 00"	81° 20' 00"			
Nov. 5	12 m.	69° 48' 30"	81° 20' 00"			
Nov. 5	5 p.m.	69° 44' 00"	81° 28' 15"			
Nov. 10	5 p.m.	70° 09' 00"	82° 35' 15"	— 13.0	32.21	68.17
Nov. 17	12 m.	70° 05' 30"	82° 35' 15"			
Nov. 20	4 p.m.	70° 06' 00"	82° 30' 30"	— 4.2	33.03	68.07
Nov. 25	12 m.	70° 25' 00"	83° 27' 00"	— 2.7	33.39	68.40
Nov. 26	12 m.	70° 23' 30"	83° 27' 00"			
Nov. 28	5 p.m.	70° 19' 45"	83° 23' 15"	— 2.4	33.46	68.20
Dec. 2	6 p.m.	70° 18' 00"	83° 33' 15"			
Dec. 6	12 m.	69° 54' 00"	83° 33' 15"			
Dec. 7	6 p.m.	69° 51' 30"	82° 48' 45"			
Dec. 9	5.45 p.m.	69° 50' 30"	82° 45' 00"	— 1.9	32.51	67.40
Dec. 12	5.40 p.m.	69° 49' 15"	82° 46' 45"	— 3.1	32.53	67.52
Dec. 20	4.30 p.m.	70° 15' 00"	84° 06' 15"	— 1.4	34.19	68.26
Dec. 22	5 p.m.	70° 18' 30"	84° 51' 00"	— 0.9	34.33	68.41
Dec. 27	4.25 p.m.	70° 20' 15"	85° 52' 00"	+ 2.7	34.30	68.31
Dec. 29	5.30 p.m.	70° 15' 00"	85° 51' 15"	+ 0.3	34.43	68.35
Dec. 31	5.30 p.m.	70° 01' 30"	85° 20' 15"	— 2.5	34.19	68.32

APPENDIX No. V

THE NAVIGATION OF THE ANTARCTIC ICE-PACK

BY

ROALD AMUNDSEN

PROFITING by the accumulated experience of centuries, the arctic explorers of our day have succeeded in obtaining splendid results. Upon the lessons drawn from the experiences of the ill-fated *Jeannette* expedition, Nansen, to a great extent, built his plan of drifting across the polar sea. The construction of the *Fram* also was based upon observations made through ages. Peary is now, with unshaken energy, step by step working his way towards the north pole. Here, what aid and support does he not derive from his predecessors, the English expedition under Nares, of 1875-76, and especially from the expedition of his countryman Greely, of 1881-84, which came to such a tragic end, but which now affords the daring arctic explorer the most valuable assistance by the depot established at Fort Conger and Lady Franklin Bay! And Nature herself lends a helping hand in always leaving the line of retreat open to the arctic explorer.

The antarctic explorer, however, is forced to work under far less favourable conditions. Earlier expeditions have, indeed, tried to penetrate far south, but without leaving any material sources of help for their successors. The honour of the earliest acquaintance with the antarctic region

NAVIGATION OF THE PACK-ICE

belongs to James Cook, who, in 1774, reached as far as to $70^{\circ} 10'$ south latitude, where a stop was put to his progress by compact ice. In 1823 Weddell reached $74^{\circ} 15'$ south latitude, and in 1842 James Clark Ross made the record of farthest south when he arrived at $78^{\circ} 9' 5''$ south latitude, which, as far as we know, still remains the southernmost point that has been reached.

The unexplored region around the north pole only constitutes about five million square kilometres; that around the south pole amounts to between twenty-one and twenty-two million square kilometres, or a tract of land corresponding to more than double the size of Europe.

While we have already learned about the arctic winter from the Dutchman William Barents, who passed the winter of 1596 in Nova Zembla, and from many subsequent explorers, the antarctic winter up to our time has remained but a fable. It was the Belgian Antarctic Expedition, led by the Belgian, Lieutenant Adrien de Gerlache, that brought the first information about the south polar night, after spending the winter in the antarctic pack-ice west of Grahamland in 1898-99.

Taking part in this expedition, I had daily opportunities to survey and study the ice which for nearly thirteen months formed our surroundings. It would be premature to pronounce a decided opinion as to the best way of navigating throughout the entire antarctic region according to the observations here made. In order to do that it would be necessary to have a thorough knowledge of the state of the ice in various places. The knowledge which Ross, and subsequently Kristensen, gained of the pack-ice north and east of South Victorialand, was widely different from that acquired by us of the ice west of Grahamland. Therefore, when I state my opinion below as to navigation in the antarctic ice, I do so with specific regard to the ice which

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stopped our progress and held us prisoners for such a long period of time.

Here it is, from the very start, quite evident to the antarctic explorer that he incurs a great risk by attacking the ice. To the south, as far as the eye can survey, he sees nothing but ice, and by experience he knows that he has to contend with a frozen ocean, agitated by storm. If his vessel should by chance be hemmed in, and possibly crushed by the ice, what ways of escape would there be open to him? The possibility of reaching land in small, open boats he certainly does not consider very great. The chance of finding human beings on new land possibly to be discovered farther south, cut off from the rest of the world by immense masses of ice, appears to be even less probable. This is, I suppose, the reason why earlier explorers have not dared to attack the ice in these regions.

It was a northeasterly gale that, on the 28th of February, 1898, forced us through the ice. Comparing this ice with that which I came across on my sealing expeditions in the arctic seas on the eastern coast of Greenland, the difference was at once apparent. While we find in the arctic ice channels and lakes several miles in length, formed by the rapid currents prevailing there, in the antarctic ice we do not find any signs of similar formations. The spaces which we found here were intermediate spaces between each separate floe of ice, broken up by the storm and carried away from its original position.

What, above all, struck me after being imprisoned in the antarctic ice was the "indolence" of the ice—that is to say, its stagnation or indisposition to move within its own bounds. That the entire main body of the ice was in lively motion soon became evident from the nautical observations, but the movements within its compass were very slight. The cause of this lack of local movement of the ice may,

NAVIGATION OF THE PACK-ICE

no doubt, be traced to the nature of the current. That currents exist here, as everywhere, is not to be doubted, but they must be very insignificant, and are surely without any importance to navigation.

From the month of December, 1898, up to March, 1899, easterly winds were predominating, and these caused a very considerable drifting of the ice. In the course of these three months we drifted in this way from about 87° longitude west of Greenwich as far as to 103° , or a distance of about 950 kilometres (this distance is calculated in a straight line on the seventy-first parallel circle). That this easterly wind, which prevailed for such a length of time and mostly with great violence, was no local wind, we can safely assume. Its place of origin was no doubt the regions around Grahamland and Alexander Islands. This gives me further cause to believe that the sea along the western coast of these countries was perfectly navigable during the months of February and March, 1899. But there is no reason whatever to suppose that this is the case every year. On the contrary, previous expeditions have always found this part of the antarctic drift-ice completely closed. We, on board of the *Belgica* in February, 1898, also found within the drift-ice along these countries absolutely no navigable water. If a future expedition were to choose the same region where the *Belgica* did its work for a field of investigation, my unqualified advice to it would be to linger for some time near the coast of these countries, awaiting a separation of the ice from the land. What a great advantage there would be in navigating alongshore! Possibly harbours might be discovered, stations built, and depots established, and one would then always have something to depend on. During our drift in the ice we never dared venture on foot so far out as to lose sight of our ship. It would be wholly different if there were regular stations from which to start the work. We could

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then safely proceed southward with a sleigh-boat and possibly accomplish fine results, for the antarctic ice, compared to the arctic ice which I have had a chance to observe, is much more level and even, and consequently easier to traverse.

I see a great advantage in having two vessels, but in that case it is necessary that both of them should be exactly on the same level in regard to power and outfit, as, in my opinion, the idea of taking along a so-called "auxiliary vessel," which in some respect or other is inferior to the principal ship, is to be entirely rejected. The principal ship, in that case, might sometimes have to perform the duty of a tugboat and take the auxiliary vessel in tow. In order that two vessels of this kind should be able to make any headway in the drift-ice, they would always have to be within sight of each other, and one of them being inferior to the other, it is easy to understand that it would be more of a hindrance than a help. It would be altogether different if we could start our work from regular stations. Then one vessel might be stationed on the coast as a reserve ship while the other pressed onward; but as long as our knowledge of the antarctic regions remains so insignificant as at present, we must, in order to work with expectation of success, employ only first-class equipment, which by experience has been proved effective.

The *Belgica* entering the antarctic pack-ice was the first ship to make the venture on this side of the globe. Almost nothing was previously known about the character of the ice of this region. Now the situation is entirely changed.

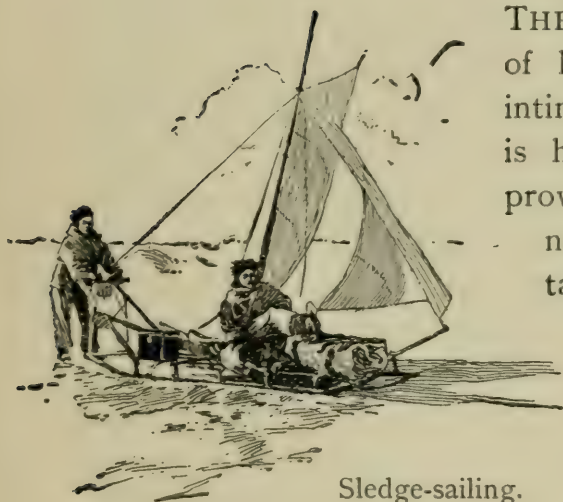
The ice has been tried and examined, and observations have been made which may prove of invaluable service to future expeditions.

APPENDIX No. VI

THE POSSIBILITIES OF ANTARCTIC EXPLORATION

BY

FREDERICK A. COOK, M. D.



Sledge-sailing.

THE heterogeneous branches of human knowledge are so intimately interwoven that it is hard to conceive an improvement in one which does not conduce to the advantage of others. The modes of association which exist between the numerous objects of mental and physical research are like the

membranes which embrace the humours of the eye, so minute and transparent that, while they give union and solidity to the whole, they themselves remain unperceived or wholly invisible. The general advancement in the knowledge of our globe, which follows the work of polar exploration, is not at first perceived. The collective results are rearranged and interwoven with the other threads which go to make up the fabric of the various branches of natural science. Around the two poles of the earth, and particularly around the south pole, there are extensive unknown

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regions. In these regions are hidden the finishing filaments of much exact knowledge. To seek these is the true object of polar exploration.

Efforts at clearing up the mysteries of the arctic will now for a time give place to projects for antarctic research. The disputed questions, bearing upon the value of such enterprises, have been answered in the affirmative by the Belgian, the British, and the German governments. Each of these governments has contributed large funds, not to find the south pole, but to gather the ends of the threads of science which are there lost in white obscurity.

The possibilities of exploration in the far south are many, and properly to understand them we must first review the regions actually known. Perhaps it is not correct to say that anything antarctic is actually known. Almost the entire space beyond the polar circle, with the exception of a few dotted lines, is a blank upon our charts. Even the sub-antarctic lands, like Tierra del Fuego, Kerguelen, and the Auckland Islands, are for scientific purposes unknown. Of the truly antarctic lands the first in time of discovery and in value is the always accessible land-mass south of the South Shetland Islands, which is erroneously charted Grahamland.

This is a large mass of land which is labelled on the various charts with different names, and is parcelled out to suit the nationality of the chart-makers. No navigator will be able to recognise the landmarks of Grahamland from any modern chart. This was the experience of the *Belgica*. The American sealer, Palmer, first saw the northern outline of this land. The British sealer, Biscoe, saw a part of the western border of the same land. But neither Palmer nor Biscoe has given sufficient information to make a chart. The British explorer, James Ross, and the French explorer, d'Urville, touched along the northeastern limits, and re-

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cently the Norwegian sealer, Larsen, has traced a part of the eastern limits. From the work of later explorers, and the guesses of the early sealers, the present map is constructed. But since the *Belgica* sailed over two hundred miles of this region where high land was placed, and since she sailed over the regions where the Biscoe Islands are placed, it is evident that even this, which is the best known of the antarctic lands, needs a general rediscovery.

The actual existence of a land, corresponding to what is charted as Grahamland, is a matter of considerable doubt. On the map it extends from the sixty-ninth parallel of latitude northward four hundred miles. Alexander I. Land, which makes the southern termination of this, is a group of islands, and we saw no land eastward. The character of the land which may or may not exist between this and the newly discovered Belgica Strait is questionable. It may be a continuous land, but, from the large indentations which we saw, it is quite as likely to be an archipelago. The possibilities of future exploration in this region are very great. The country is easy of access, and has an abundance of bays and channels, which will afford shelter to exploring vessels. It offers scientific and commercial prospects promised by no other new polar region.

Following the polar circle from Grahamland eastward, the next land is Enderbyland. Ten degrees farther another line is put down and named Kempland. Enderbyland was reported by Captain Biscoe in 1831. The pack-ice was so closely set around the land that Biscoe was not able to debark or approach within twenty-five miles. So far as we know, he saw but one headland to distinguish the land from an iceberg.

Kempland was also inaccessible, and Captain Kemp, the British sealer who discovered it, gave on his return only a verbal report. Captain Morrell, an American sealer, but a

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few years previous sailed over an ice-strewn sea about fifty miles south of both Enderbyland and Kempland without seeing anything resembling land. This makes it extremely probable that neither Enderbyland nor Kempland is a large mass connected with any other land. The geographical problems which seem to be indicated here are: Is this an archipelago, like the Palmer Archipelago, fronting a higher and more continuous country or continent? Or is it an isolated group of islands? An expedition devoted to this object and this only would add certain and unique records to geographic and all other sciences.

Following the polar circle still farther to 100° of east longitude, and close to the circle, there is another interruption in the unknown. This is the much-disputed Wilkesland. It is by far the largest land-mass in the entire antarctic area. The land, including Victorialand, its better-known eastern border, occupies more than one sixth of the circumference of the globe. It covers more degrees of longitude than the entire spread of the United States. In a territory of this extent, even under the most hopeless spread of snow, would it not be strange if something of value and much of interest were not found? It is not at all probable that the disconnected lines seen by Wilkes are a continuous line of the continent. These are, very likely, off-lying islands which front a great continent. We are led into the conviction that there is a continent here by the very great number and the enormous size of the icebergs which were here encountered. But this conviction without better evidence will not, and ought not to, satisfy explorers. Wilkes made his voyage of exploration in small vessels which were not specially strengthened for ice work. If he was able to approach the coast in ordinary ships, a vessel fitted for ice navigation will certainly be able to get nearer and bring back more definite results.

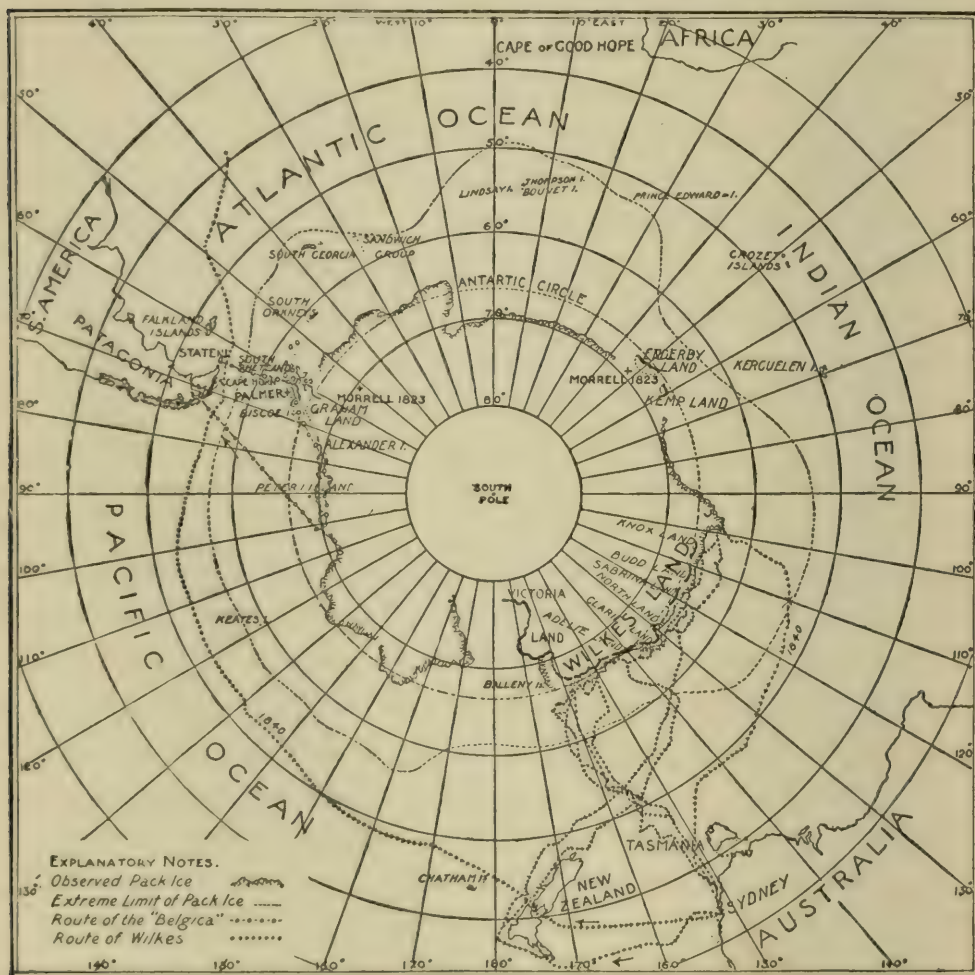
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From Victorialand to Grahamland there is but one spot to interrupt the movement of the great sea of restless ice. This is Peter Island. It was discovered by the Russian explorer, Bellingshausen, in 1821, and it has not been seen since. The *Belgica*, in her year's drift, came close to the assigned position, but we saw no indications of land. It would be interesting to know if this island really exists, and if it is not a part of another small archipelago.

Before passing from the known to the possibilities of the unknown, I will answer the business man's question: "To whom do these lands belong?" It seems to me that the nations seeking to divide China and Africa might turn their ambitions briefly towards the antarctic. Here are millions of square miles which belong to nobody; at least, there are no valid claims filed, except those which accrue from the right of discovery. Victorialand would seem to belong to England, but it is possible for the United States to lay a strong claim by right of extension of territory. Wilkes, the American explorer, was the first to see and to chart the great masses of land of which Victorialand is a part. The work of Ross, though better in quality, is supplementary to that of Wilkes, which gives the United States a priority claim. There is also a small French claim. There is indeed room for a future boundary dispute of the limits and claims of the Americans, English, and French in Wilkesland. The British Government seems to have no doubt on this question, for twelve years ago the Queen issued a grant for Possession Island, making Mr. Albert McCormick Davis, of Montreal, colonial governor of its numerous cities of penguins, and giving him for a stipulated period a monopoly of its guano-beds. Mr. Davis never rose to the dignity of being the first south polar king. He was content with the honours of appointment, and returned his credentials three months after their issue.

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Peter and Alexander islands, and one or two islands of the Sandwich group, belong to Russia. The Bellany and Biscoe and Sandwich groups, as well as Enderbyland and Kempland, belong to Great Britain. Grahamland, like



Wilkesland, offers many bones of contention. The entire northern coast should belong to the United States. A part of the eastern coast, and a part of the still uncharted western coast, belong to England. Norway has a claim for about two hundred miles on the eastern coast. The recent discoveries of the *Belgica* give to Belgium the most beautiful and the most useful body of water in the entire antarctic area.

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In the adjustment of these various claims there is no end of trouble in store.

It is generally held that all these countries belong to nobody—indeed, that they are not worthy of ownership; but this is not true. The issue of a grant for Possession Island is an indication of the sentiment in England; another indication is to be perceived in an incident which happened a few years ago. The Argentine Government, being anxious to secure possession of the South Shetland Islands, aiming probably to control the harbours and the possible fisheries, made some preparation to place there a lighthouse and thus take possession by right of prior occupation. In response to this, according to a rumour said to have been based on official instruction, a British cruiser was ordered to speed, as soon as the Argentine steamer left port, to the South Shetlands and there to receive the Argentinos. The long period which has elapsed since the discovery of everything antarctic weakens the natural claims, and any one who now takes the trouble to occupy any portion of it would undoubtedly become the owner. The man who sits on the southern ice, under the hellish antarctic storms, long enough to make good his deed, deserves all there is under him, even if it proves a Klondike.

I must beg leave to differ with the prevailing opinion, regarding polar exploration, that there is no commercial or material reward commensurate with the expenditure of time and money. In the antarctic there are several prospective industries, and much of the future work has a direct bearing upon commerce. There are seals, penguins, and whales in abundance around the circumpolar area. Every rock which offers an accessible beach is covered with either seals or penguins, and every channel of open water between the pack-ice or around the ice-sheltered lands is alive with whales. Fur-seals were at one time so numerous that a

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whole fleet of American sealers were engaged in the hunt; but the fur-seals are now nearly extinct. The several varieties of antarctic seals have a coarse coat of single hair which is useless as a fur; but the skin and oil are of considerable value. There is no reason why a profitable fishery could not be prosecuted, like that off the coast of Labrador and Greenland. The penguins are not widely known to commerce, but their countless millions will surely attract enterprise and yield some useful product. Already they are being taken at the Falkland Islands for the oil they possess. We must abandon the hope that right whales, possessing the prized whalebone, exist here in numbers sufficient to warrant a promise of future whaling. Ross reports having seen right whales, but a diligent search since has failed to confirm this report. From the *Belgica* we saw no whales of this variety, but finback and bottlenose whales were seen in great numbers. These are small whales having no bone of commercial value, and a somewhat inferior quality of oil. But the hunt for a similar variety of whales in Norway has given profitable employment to thousands of men in the past ten years. Whaling and sealing in the antarctic cannot, however, be made to pay the enormous expense of fitting out from Europe and North America for so distant a hunting-ground. To make these industries successful, permanent bases must be established either in the antarctic, on the sub-antarctic islands, or in the southern parts of South America or Australia.

The guano-beds of Possession Island offer an enterprise which seems to promise certain results. The guano is rich in nitrates, and exists in quantities sufficient to keep a fleet of cargo-vessels occupied for years. There are strong possibilities of the existence of hundreds of other islands within the area of the unknown, loaded with a similar or even a greater weight of the fertiliser. Such islands may

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be found in more accessible places, outside of the pack-ice, off the coast of Grahamland, or among the partly known groups such as the South Shetland, Bouvet, Prince Edward, or Macquarie islands.

The future for fisheries and guano industries has an appearance of reasonable certainty, but this is not true of the possible mineral wealth or of other revenue-bearing material which may be hidden behind the icy gates. Our geological knowledge of this area is still too imperfect to offer even a guess of the probable finds of precious metals or gems. Arguing by analogy, the South Shetlands in general appearance, and what little is known of the geological formation, resemble Tierra del Fuego, and we now know that gold is here found in paying quantities. Since these islands are an extension of the Fuegian lands, is it unreasonable to expect to find gold here? An antarctic Alaska is by no means beyond the future possibilities.

Are there not people or unknown animals in the regions around the south pole? Novelists have pictured this mysterious region since the time of Dalrymple, in 1760, with curious races of people and strange forms of animal life. It is the last unexplored expanse on the globe of sufficient area to offer room for fictitious creations of new worlds, and it will continue to be a special domain for imaginative writers for many years. From the explorations thus far, we have no reason to hope for any startling discoveries of human or other animal life. Borchgrevink, owing to his inexperience and hasty conclusions, mistook ordinary penguin tracks for the footprints of some large and unknown animal. No reliable traces of either large new animals or human beings have been found. The regions are, as homes for adapted people, far superior to the arctic lands, where the Eskimos periodically starve or live in blubbery abundance. If sailors or wild people were cast

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adrift on the antarctic shores they would not necessarily starve. There is food and fuel, and even clothing, to be had from the seals and penguins everywhere. The life would not be full of comforts, if measured by our standards, but compared to Eskimo existence there is a decided advantage in life-sustaining prospects of the southern pole—not in climate or in the degrees of cold, but in the certainty of food. People then, if they once find a foothold, might easily thrive, but to the present we have found but one doubtful sign. This was reported by Captain Larsen, the Norwegian sealer, in 1893. Larsen found about fifty clay balls, perched on pillars of the same material, on Seymour Island, off the eastern coast of Grahamland. "These," said Larsen, "had the appearance of having been made by human hand."

There is one train of industries for which the antarctic and sub-antarctic regions offer the best conditions of the globe. This is the farming of fur-bearing animals. It is an industry which is still in its infancy, but the recent experiments upon the barren Alaskan islands have been eminently successful. There are thousands of isolated islands in the southern oceans which offer just the conditions for the cultivation of such life. These islands, though almost barren of vegetable life, are fertile with birds and seals and smaller forms of marine life, which will offer food to prospective generations of transplanted animals. So far as I know, this is a new suggestion to the future south polar possibilities, but the conditions which I have seen are too favourable to be ignored. The antarctic lands lie isolated in a deserted and frozen sea. The drift-ice and the overland mass of glacial ice bar the passage to adventurous travellers who seek to penetrate the mysteries of the frozen south. But it is just these barriers which fence the "land of promise" for the coming fur-farmer, who is to

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take the place of the life-destroying hunter. I am sure that in the near future these wild wastes of the antarctic, with their million of bird-inhabited islands, will form an island empire of thrifty fur-farmers. What nation shall guard the interests of this coming race of hardy pioneers?

Independent of material results, a continued exploration of the antarctic will certainly disclose priceless scientific acquisitions. A region of the globe nearly eight million square miles in extent, into which the foot of man has not yet trodden, is not likely to prove barren of scientific data. The polar question is not a problem of adventure, as it is ordinarily thought to be, nor is it a matter of dollars and cents. It is a problem of science, and has for its principal objects an exact knowledge of the limits of land and water; a careful study of the physical condition of the earth and of the life; in short, it aims at perfecting that network of lines with which comparative science seeks to surround our planet even at the poles. The prosecution of this labour will add to our knowledge of the physical laws which regulate climates, which indicate the origin and destiny of atmospheric and sea currents, and which serve as analogies for geology and other natural sciences. The Gulf Stream was discovered by a study of polar phenomena. Our present knowledge of the glacial system, which, at some distant time, covered not only the poles, but the lands we now inhabit, would not have been conceivable without a knowledge of the present polar ice. Who will say that new gems will not be added to the annals of science by antarctic explorers?

Specifically, terrestrial magnetism, geography, meteorology, geology, and oceanography are to be most enriched by the results of far southern exploration. Magnetism has an important bearing upon the navigation of the southern hemisphere, and even upon the land surveys. If the bear-

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ings of the compass cannot be accurately deduced, evidently the course of a ship or the base-line or fixed point of a survey must be unreliable. For greater accuracy of the all-important compass, more continued and more prolonged magnetic observations in various parts of the antarctic are indispensable. Even the seemingly simple task of fixing by calculation the location of the south magnetic pole is, with our present knowledge, impossible. The positions assigned by the best authorities differ several hundred miles from each other, and the work of the *Belgica* placed it approximately two hundred miles east of the spot designated by Ross, whose observations have been generally accepted.

Closely associated with the magnetic pole is the mysterious phenomenon, the aurora australis. It would be interesting to have a prolonged series of auroral observations to add to the first records taken by the *Belgica*. Perhaps this information would help to solve the puzzling questions of the physical character and the origin of the mysterious celestial lights. Some of these questions are: What is the difference between the aurora australis and the aurora borealis? Is there any coincidence in the appearance of the phenomena at both poles? What is the relation of the exhibits with the sun-spots? What relation have auroras with meteorological phenomena—the weather, the clouds, the atmospheric electricity? What are the connections between auroras, earth-magnetism, and telluric currents?

The geographical possibilities have been indicated in our discussion of the known lands. It would be interesting to know if the various traces of land, so close to the polar circle, are or are not connected to form one large continent. What are the physical conditions of this great unknown area of land or sea? Geographically, this is the only remaining unknown expanse of our globe where great discoveries may be expected.

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The interior south polar lands are likely to prove the coldest part of the earth. This is contrary to what might be expected, because the great circular sea which surrounds the entire globe should warm the comparatively small expanse of land. In the region of the *Belgica's* drift, however, the indications were otherwise. Our position was in a restless sea of ice, far from land, with large open lanes of water constantly about us. It follows, then, that we should have had a mild marine climate. But our temperatures were persistently low, from -5° to -45° C., rarely above the freezing-point. And, following southerly winds, the mercury at once sank into the bulb. The suddenness and intensity of cold which came with interior winds bespeaks a very high and a very cold area. This question and a hundred others will be solved by meteorological studies. Problems of weather are associated with neighbouring phenomena. For the proper understanding of the climate of the southern hemisphere there is necessary a long-continued series of meteorological studies within the limits of perpetual ice.

In geology nearly everything remains to be done. Here are indications of some very interesting problems. Among them are the numerous open questions of the great ice age. In the period immediately preceding the ice age the polar regions were not, as they are now, submerged under a continental sea of ice, but had a somewhat profuse growth of plants, extending even to the base of the mountain glaciers. The fossil remains which have been found in the north and in the south prove that at this time there existed, among these growths, plants which are now found only in sub-tropical regions. This period was a noteworthy epoch in the history of our planet. It was the time when man first appeared, and it was the time when the earth was dressed in her best mantles. The continents then had a greater

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extension, the life a curious diversity, and the forests were much more luxuriant than they are to-day. The antarctic is likely to throw new light upon this interesting period. The fossil finds may establish the previous existence of a life of which we now have no indication. In the many departments of geology we may expect startling discoveries.

To zoology the south offers less flowery prospects than to the other sciences. The study of the organic life is important for the understanding of the earlier life of our planet, but some of this has been gathered. The work which remains to be done is the detail of anatomy and physiology and the study of microscopical forms of life. It is not probable that there remain large animals of which we have found no traces.

Probably the most important results of immediate practical use to both science and commerce, will be the gain to the newly born science, oceanography. The ever-increasing usefulness of the ocean for the needs of modern commerce or warfare, of cable service, and as a nursery for food, makes it necessary that we know as much as possible about it. We must know not only the surface, but the bottom and intermediate waters. We must know not only the warm seas, but the cold as well. There is a constant interchange between the water of the tropics and that of the poles, just as there is an interchange of the winds. The cold, ice-laden waters have a tendency to flow into the warmer regions. The overheated torrid waters flow poleward. This is the theory, and in part it is supported by observation; but what is the mechanism?

It is evident that the missing keystones to the rising arches of science are many, and the material for some of these will certainly be found in the neglected blank around the under-surface of our globe. The reasonable certainty of these results is likely to arouse a south polar enthusiasm within a few years, and in anticipation of this I wish to

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offer a preliminary word of warning. Up to the present, antarctic history has to record no great loss of life, no awful calamities, like the arctic tragedies. If due precaution is taken, none should be reported. The arctic and the antarctic are alike only in degrees of cold and in the quantities of ice. Even in these they differ somewhat, and in every other respect there is little resemblance. From this it follows that an antarctic explorer should be differently equipped from the man who travels in the far north. The hopeless isolation and impossibility of retreat make a fixed outline, a permanent station, and strong vessels imperative.

Should an expedition risk their fortunes, as did the crew of the *Belgica*, in a single vessel, and in the unknown drift lose their ship, which is always possible, the disaster would mean certain death for nearly everybody. It is true that the *Belgica* experienced no great damage by pressure, but that we escaped with our vessel is a matter due quite as much to accident as to any wisely prompted construction of the ship. If a field of ice two miles in diameter should press upon any vessel in the wrong situation, it would certainly crush her. This is always to be expected in antarctic navigation, and it makes a companion ship desirable. The south, also, is a hard school for explorers. Young men who wish to engage in this work should take their schooling in the more congenial arctic regions.

From what we saw of the antarctic lands south of Cape Horn, it is clear that the previously conceived impossibility of landing on south polar lands is a misconception. The *Belgica* made twenty debarkments, and it was discovered that it was possible to land on nearly every island and neck of land offering a projecting northerly exposure. From the experiences of the *Belgica* it would seem that a permanent base of operations might be established far south, either in Weddell or in Ross Sea. These are the only regions

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offering a promising route to the south pole. The possibilities of reaching it will depend upon the character of the inland ice. If it is a smooth, even surface, without mountain ridges or extensive crevasses, such as the interior of Greenland, and if this land ice extends to the pole, then it is within the power of man, with present means, to tread on the spot; but if it is otherwise, then there is only a small prospect of reaching the southern axis.

In the future exploration of the south polar regions there is the prospect of universal association which has long been the golden dream of science. Indeed, just at present such international alliances are the topics of the hour. The final filaments of the fabric which will bind together the three greatest nations of the earth are being spun. It is not a triple alliance in an ordinary sense; it is one of the products of the evolution of nations. It is a natural selection of the three peoples best fitted for each other. England, Germany, and the United States are, at present, held together by a sort of matrimonial bond, and this bond must be strengthened. Could there be a more fitting seal to this family union than a triple alliance to explore the last great unknown area of the globe? England and Germany are organising expeditions. Will Americans, who have carried the Stars and Stripes to the farthest reaches of the earth, stand aloof and look on? If we are to have a well-equipped expedition, ready to work with England and Germany, some merchant king must come to our rescue. The present government indications are not favourable to such a venture, but with the liberal hand of a Bennett, a Harmsworth, or a Jessup, we could work hand in hand with the subjects of the Queen and the Kaiser. The combined armies of peace could, in this way, march into the white silence, the unbroken, icy slumber of centuries about the south pole, and there collect the needful scientific spoils.

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